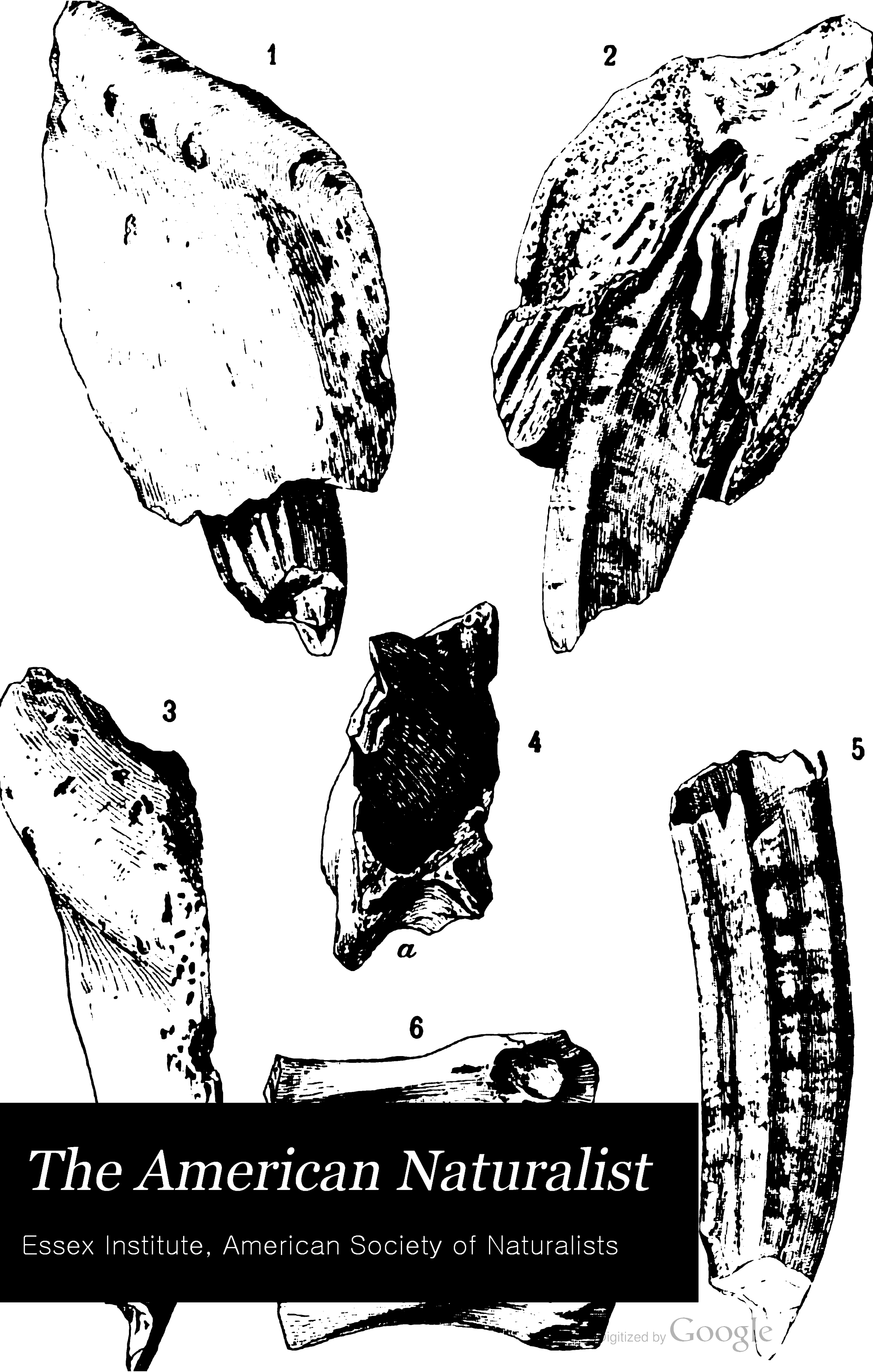


The American Naturalist

Essex Institute, American Society of Naturalists

W. G. FARLOW.

THE

AMERICAN NATURALIST

VOL. XXIV. JULY, 1890. 283.

THE CETACEA.

BY E. D. COPE.

THE Cetacea, as the inhabitants of the water areas of the earth's surface, have had ample space for variation and multiplication of forms, an opportunity of which only a moderate advantage has been taken. The conditions have been more uniform than those to which land mammals have been subject, and a corresponding uniformity prevails in this order. Owing to their habitat, opportunities for their preservation have been better than in the case of animals of the land, and accordingly great deposits of their bones exist, notably on the east coast of the United States, and in certain deposits of Belgium and Italy. Among the species brought to light in these localities, as among those now existing, we find examples of the most gigantic, not only of the Mammalia, but of the Vertebrata. The exising *Balænoptera borealis* reaches a length of over one hundred feet; and several other species, including the sperm whale, attain to eighty feet.

The order of Cetacea is one of those of whose origin we have no definite knowledge. It appears sparingly in the Zeuglodontidæ in the Eocene period, and has its greatest multiplication in the ages of the Miocene. The Zeuglodontidæ are the most generalized family, and forms intermediate between them and the modern Cetacea are found in Miocene beds. Modern types are, however, contemporaries of the latter, and these have achieved a multiplication of forms in Pliocene and modern times.

The line of successional modification of the Cetacea is found in changes in (1) the shape of the skull; (2) the extinction of the dentition; (3) the shortening of the cervical vertebræ; and (4) in the separation of the ribs from articulation with the vertebral centra. The modification of the shape of the skull is related to the gradual transfer of the external nostrils to more and more posterior positions, until they remain, in the extreme types, above, or even behind above, the eyes. In this process the nasal, frontal and parietal bones become excessively abbreviated, so that in the modern toothed whales, they form a narrow band between the nostrils and the superior border of the occipital bone.

The order is naturally divided into three sub-orders, which are defined as follows:

External nostrils on the superior side of the muzzle; teeth present; ribs with two heads; *Archæoceti.*

External nostrils above gullet; teeth generally present; no whalebone; some of the ribs with two heads; *Odontoceti.*

External nostrils above gullet; teeth wanting; the gums supporting "whalebone"; ribs articulating by tubercle only; *Mysticeti.*

All of the above characters are those of divergence from the principal mammalian stem, and have relation to the conditions of aquatic life. Thus the posterior position of the nostrils permits inspiration without the elevation of the muzzle above the water-level, which is rendered difficult, if not impossible in the most specialized types, by reason of the extreme flatness and inflexibility of the cervical vertebræ. The absence of teeth is appropriate to the habits of the types which lack them. Thus the Physeteridæ among Odontoceti feed principally on squids, whose soft bodies are swallowed whole. The Mysticeti feed on minute Crustacea and Mollusca, which they retain in the mouth by straining the water through their bristly whalebone, or baleen. The disarticulation and disappearance of the heads of the ribs in the Mysticeti, is appropriate to the support which all the viscera derive from the fluid medium in which these large animals live. Strong articulation of the head of the ribs to the vertebral column is no longer necessary.

Paleontology confirms the inference derivable from their anatomy, that the phylogeny of the Cetacea has followed the order, Archæoceti, Odontoceti, Mysticeti.

The mechanical causes which may have given origin to the modifications which measure this succession, may be suggested as follows: The shortening and obliteration of the neck is probably due to disuse, since the general mobility of the body in a watery medium renders much flexibility of the neck unnecessary, the entire body being readily turned about. It may have resulted, also, from the increase in the relative proportions of the head, which renders it extremely difficult to handle; a function which is, in the modern Cetacea, quite aborted. The early and rapid reduction, and in some lines, extinction of the dentition, is a result of disuse consequent on the increasing percentage of soft or minute food used by the more modern types. So the loss of the rib-heads in the Mysticeti may be traced to disuse, since, as above remarked, they lack the strain caused by the weight of the thoracic and abdominal walls and the contained viscera, which they experience in animals which are not supported by some external medium. The same reduction took place in the ocean-dwelling Plesiosauria,[1] and in those terrestrial reptiles in which the weight of the body is borne on the earth, as the lizards proper, and snakes. As regards the gradual transfer posteriorly of the external nostrils, the following mechanical hypothesis has been suggested. They have been used as a discharge pipe for air and water from the lungs and mouth, and, of course, facility of exit is directly as the shortness of the conduit. It is possible that the constantly recurrent presence of a column of air and water on the posterior inferior wall of the nareal canal has literally pressed back this obstructive roof, until it has ceased to resist the outflow by becoming vertical.

I. ARCHÆOCETI.

This suborder embraces but one known family, which is defined as follows:

Frontal bones with flat, expanded supraorbital region; teeth two-rooted posteriorly, one-rooted anteriorly; *Zeuglodontidæ.*

[1] It must be remarked here that the equally marine Ichthyopterygia have two-headed ribs, but they are of equal length, close together, and mechanically equivalent to one.

The species of this family belong to the genus Zeuglodon[2] Owen, although when the *Z. brachyspondylus* Müll. is better known it may be found to be referable to a distinct genus, Doryodon Gibbes. The longer known *Z. cetoides* Ow. is distinguished by many peculiarities. Its skull presents a long symphysis of both premaxillary and mandibular bones. The cervical and dorsal vertebræ are of similar and medium length, while those of the lumbar region are remarkably elongate. The fore-limb was short, and in its cubital region quite narrow (teste Müller). The enamel of the teeth is wrinkled, and the posterior two-rooted teeth have coarsely serrate cutting edges fore and aft. The animal could not have been less than seventy feet in length. Bones of species of Zeuglodon have been found in the Upper Eocene of Arkansas and the Gulf States (in the White Limestone of Alabama), and of England and Egypt. It is also recorded as occurring in the Miocene of Malta.

II. ODONTOCETI.

This group is the most numerously represented by species, recent and extinct. The families differ as follows:

I. Teeth of two types, one and two-rooted.

Neck longer; teeth in both jaws; *Squalodontidæ.*

II. Teeth uniformly one-rooted,

a, Ribs nearly all two-headed.

Teeth in both jaws; neck generally longer; *Platanistidæ.*

Teeth in lower jaw only; neck short; *Physeteridæ.*

aa, Four or five anterior ribs only two-headed.

Teeth in both jaws; neck short; *Delphinidæ.*

The SQUALODONTIDÆ resemble the Zeuglodons in the form and character of their teeth, but the form of the skull is very different. They nevertheless, by their intermediate position, indicate the ancestral relation of the Zeuglodontidæ to the other Cetacea. But little is known of the skeleton of the Squalodontidæ. The species occur in Miocene beds of North America and Europe. They did not attain such huge proportions as the Zeuglodons, and did not exceed thirty feet at the most. The genera known are two, as follows:

[2] *Basilosaurus* Harl.

The posterior molars two-rooted; *Squalodon* Gratel.
Some of the posterior superior molars three-
rooted; *Trirhizodon* Cope.

Squalodon grateloupii Pedroni and *S. antverpiensis* Van Ben. are the most abundant European species. In America the *S. atlanticus* Leidy has been found in New Jersey and Maryland, and the *S. holmesii* Leidy, a species with more delicate teeth than the last, has been discovered in South Carolina.

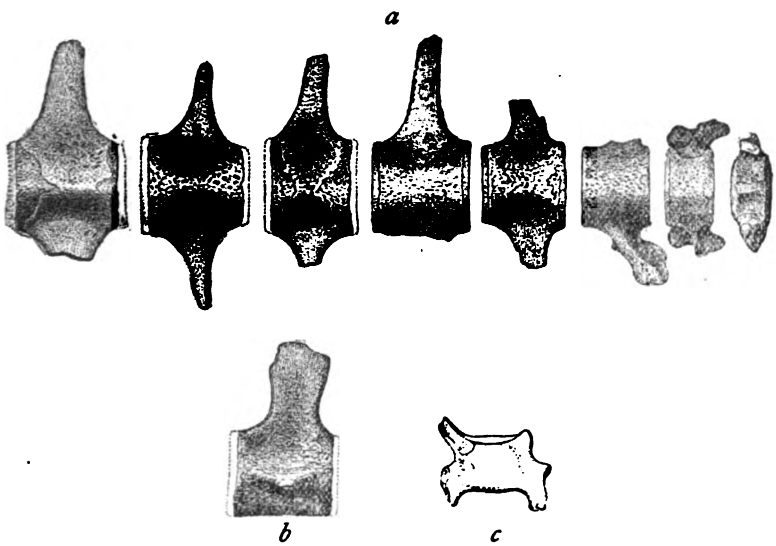


FIG. 1.—*Ixacanthus spinosus* Cope dorsal and lumbar vertebræ, two-sevenths natural size; *a*, from below; *b*, lumbar from side; *c*, cervical from front. Type; original; from Miocene of Maryland.

The greater number of the PLATANISTIDÆ are extinct. The genera differ much among themselves in the number and form of the teeth, and the relative form of the neck. Some of the species reach the size of the smaller whales, as the *Cetophis heteroclitus* Cope; but most of the species have the average dimensions of the dolphins. The genera differ as follows:

I. Teeth with roots extended transversely.

Teeth with lateral basal lobes; lumbar diapophy-
ses wide; *Inia* Geoffr.

II. Teeth with cylindric roots.

a, Caudal vertebræ plano-convex.

No caudal diapophyses; *Cetophis* Cope.

aa, Caudal vertebræ plane.

β, Lumbar diapophyses spiniform.

Lumbar and caudal vertebræ slender; *Zarhachis* Cope.

Lumbar and caudal vertebræ short; *Ixacanthus* Cope.

ββ, Lumbar diapophyses wide, flat.

Muzzle elongate, slender; cervical vertebræ long; *Priscodelphinus* Leidy.

Muzzle slender; cervical vertebræ shorter; *Pontoporia* Gr.

III. Teeth with longitudinally flattened roots.

Teeth in entire length of maxillary bone; symphysis connate; *Stenodelphis* Gerv.

Teeth on all the jaws; symphysis not connate; an erect osseous crest on posterior part of maxillary; *Platanista* Cuv.

Teeth at the base of the maxillary only; muzzle produced into a sub-cylindrical beak; *Rhabdosteus* Cope.

IV. No teeth; an alveolar groove.

Muzzle depressed, elongate; *Agabelus* Cope.

The recent species belong to the genera Inia, Pontoporia and Platanista. The two first are found in the rivers of S. America, and the *Platanista gangetica* in the rivers of India. Their posterior ribs are one-headed. The genera with spiniform diapophyses of the posterior vertebræ are only known so far from N. America. The *Ixacanthus cœlospondylus* Cope was a short robust species about the size of a white whale. Another line of modification is seen in the attenuation of the vertebral column. The most remarkable elongation of the vertebræ is found in Zarhachis, a character which is only paralleled in Zeuglodon. Of the other genera, Stenodelphis, with its single species *S. canaliculatus* (Delphinus, von Meyer), has been so far found in the middle Miocene of Central Europe. Priscodelphinus occurs in the Miocene of North America and Europe. The *P. grandaevus* Leidy (Figs. 2 and 3), of the Miocene of New Jersey has a slender muzzle, with a full series of curved cylindric teeth; a neck like that of a seal

in proportions, and a long slender body. The first sternal segment is T-shaped, and the ribs are slender, compressed, and mostly two-headed. The paddles are unknown. Other species of the genus are found in the Miocene beds of Maryland. The species of the remaining five genera have been found thus far only in the Miocene of North America. Nineteen species of Platanistidæ have been described from the latter region.

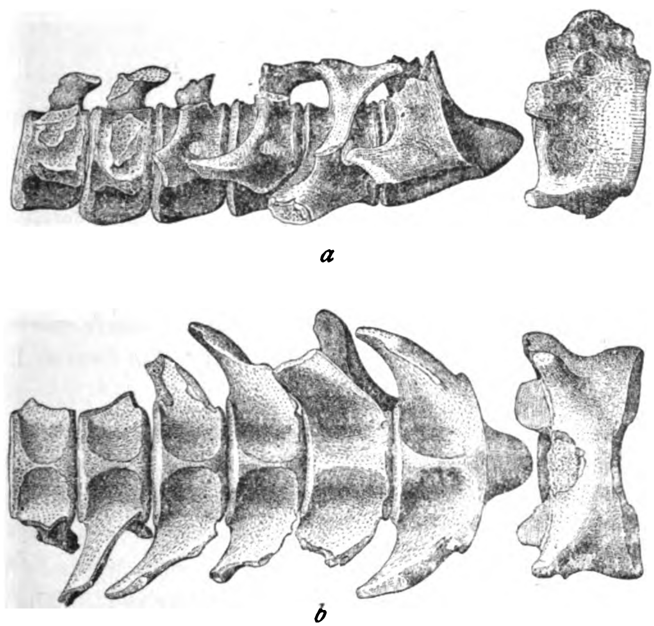


FIG. 2.—*Priscodelphinus grandaevus* Leidy, cervical vertebræ; *a*, from side; *b*, from below. Original; from Miocene of Cumberland County, N. J. One-third natural size.

One line of modification observable in the extinct genera is towards the extreme which is seen in Rhabdosteus Cope. Here the muzzle reaches an extraordinary elongation, and for the greater part of its length forms an edentulous cylinder, which resembles the beak of the sword-fishes. The few teeth which remain at the base of the muzzle are like those of Platanista, with roots compressed so as to be longitudinal, and crowns compressed so as to be transverse, to the axis of the skull. The *R. latiradix* Cope (Fig. 4.), is not uncommon in the Miocene beds of Maryland. Its

skeleton is unknown. The nearest approach to Rhabdosteus is made by the genus Stenodelphis. In Cetophis, the caudal centra have one face very convex, offering greater flexibility than is possible in any other genus. The *C. heteroclitus* is from the Maryland Miocene. A genus Lophocetus has been established for the *Delphinus calvertensis* of Harlan, also from the Maryland Miocene. Its position is uncertain; the skull resembles that of Inia, but the roots of the teeth are cylindric. The temporal and occipital ridges are very strong. Skeleton unknown. Delphinodon Leidy is represented by teeth only, from N. American localities, but a skull is described by Burmeister from Buenos Ayres, which shows that the nostrils are much more anterior in position than in Lophocetus.

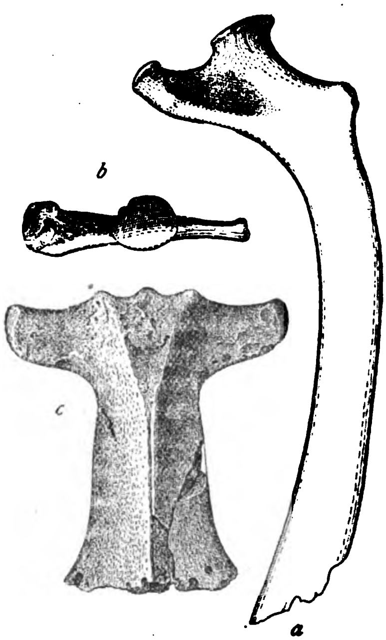


FIG. 3.—*Priscodelphinus grandaevus* Leidy; one-half natural size; Miocene of Cumberland County, N. J. *a*, rib from side; *b*, do. proximal extremity; *c*, mambrium sterni. Individual represented in Fig. 2.

Extinct and recent forms about equally divide the PHYSETERIDÆ, but the largest dimensions are reached by the recent sperm whale, *Physeter macrocephalus* L. The modifications of the family type are chiefly those of the dentition, but the skull develops crests of a peculiar character in a number of the genera. These are distinguished as follows:

I. Lower jaw with numerous teeth.

a, Teeth with crown and root continuous, and without enamel. Inion and temporal ridges forming a crest which encloses a basin-shaped cavity of the front.

Zygoma complete; symphysis mandibuli long; *Physeter*[3] Linn.

[3] *Eucetus* DuBus.; *Physetodon* McCoy; *Stenodon* VanBen=*Orycterocetus* Leidy.

PLATE XX.

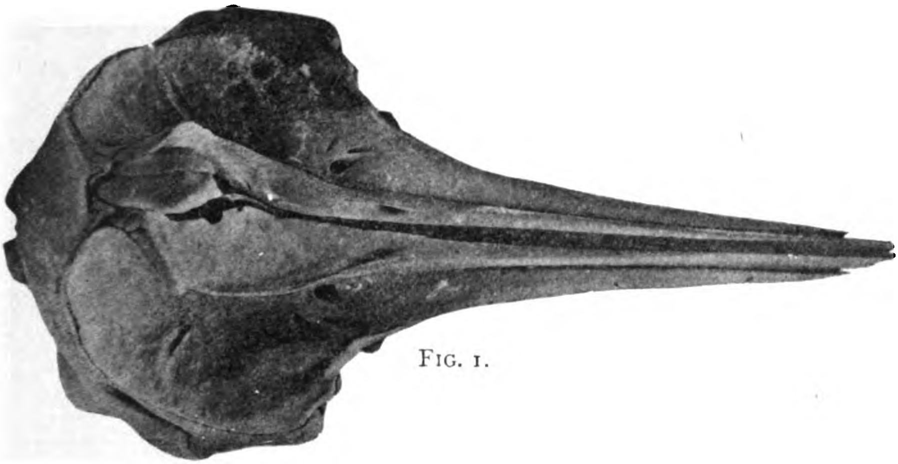


FIG. 1.

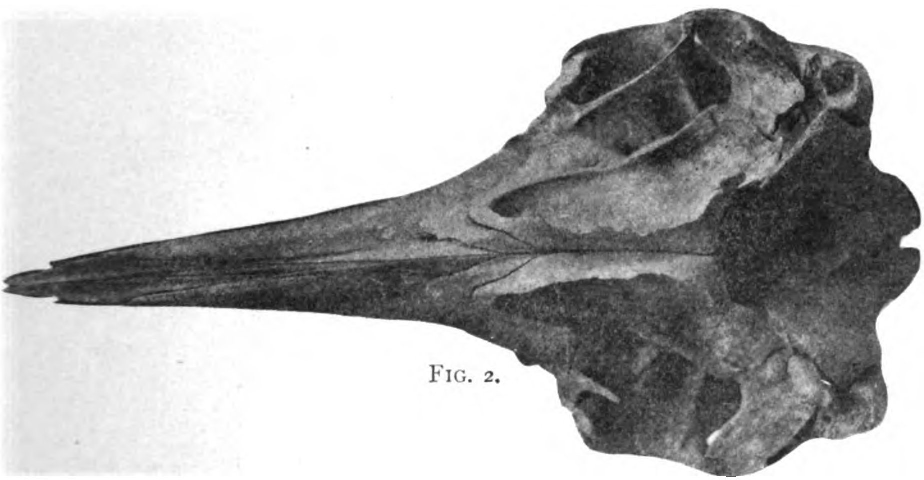


FIG. 2.

FIG. 3.

Choneziphius semijunctus Cope.

Zygoma interrupted; symphysis short; *Kogia*[4] Gray.

aa, Teeth fusiform, with enameled crown.

Cement coating thick; *Physodon*[5] Gerv.

aaa, Crown and root of teeth distinct; crown with enamel.

Cement very thick; *Hoplocetus* Gerv.

II. Low jaw with very few teeth.

a, Maxillary bones with vertical longitudinal crest behind.

A tooth at the extremity of each ramus mandibuli; *Anarnacus*[6] Lacep.

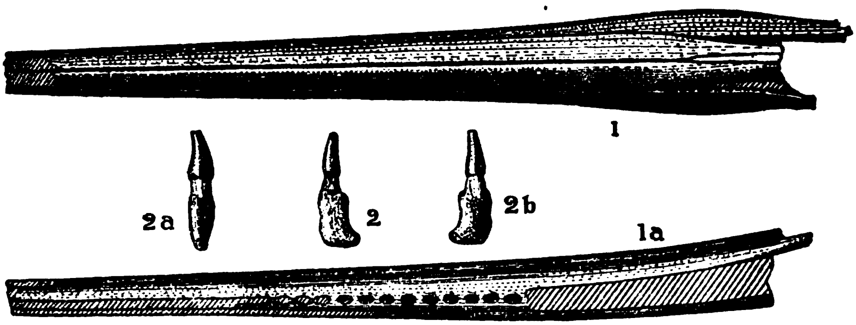


FIG. 4.—*Rhabdosteus latiradix* Cope (type); two-ninths natural size; original; from Miocene of Maryland. 1, muzzle from above; 1*a*, do. left side; 2, 2*b*, tooth from side; 2*a*. do. from edge. The posterior parts of the maxillary and premaxillary bones are restored from a different specimen from that represented in the rest of the figures. Teeth also separate; two-thirds natural size.

aa, Maxillary without vertical posterior crests.

Two teeth at the extremity of each mandibular ramus; *Berardius* Less.

Mandibular ramus with a terminal tooth; *Choneziphius* Duv.

Mandibular ramus with a median tooth; *Mesoplodon* Gerv.

As already remarked, the extinct sperm whales do not equal in dimensions the single recent species. Their teeth differ a good deal from those of the latter. Thus the American form, which Leidy called Orycterocetus, have the crowns quite slender, and the pulp-cavity large. They occur in the Miocene beds from

[4] *Physeterula* Van Ben.

[5] *Scaldicetus* DuBus [?]; *Balænodon* Owen. [6] *Hyperoödon* Lacep.

Maryland to North Carolina. The species from the Miocenes of Belgium and Australia have the pulp-cavity very small. The Kogias or pigmy sperm whales are found in all southern and tropical seas. A single extinct species, the *K. dubusii* Van Ben. has been found in the Miocene beds of Belgium. *Hoplocetus carolinensis* Leidy is from the phosphatic deposits of South Carolina. But one extinct species of Anarnacus (Hyperoödon) (Fig. 5), has

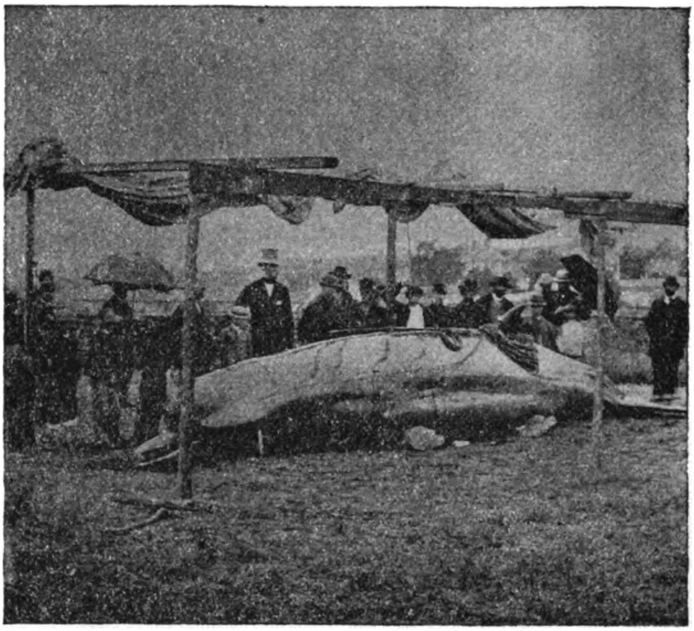


FIG. 5.—*Anarnacus rostratus* Wesm, from a photograph taken at Newport, R. I.

been yet found (in Belgium), but species of Choneziphius are abundant in the Miocene beds of both Europe and North America, Five species have been described by Leidy from the South Carolina phosphatic beds, of which the most conspicuous is the *C. trachops*. Mesoplodon is represented in the same formations by one species, the *M. prorops* Leidy. A species of each genus still lives on the coast of the United States, the *Choneziphius semijunctus* Cope (Plate XX.), and the *Mesoplodon bidens* Sowerby.

The DELPHINIDÆ are preëminently a modern type (Fig. 6). They display a tendency to the reduction of the rib heads, which is completed in the whale-bone whales, and the nostrils are far posterior, and the nasal bones mere tuberosities. The dentition differs within moderate limits; the killers, as the carnivora of the sea, having it powerfully developed, while in the grampus and Globiocephalus many of the teeth are shed. Monodon develops a large incisor with which it breaks the ice in Arctic regions. The genera differ as follows:

I. Cervical vertebræ mostly distinct.

a, Incisors not differentiated.

Teeth few, caducous; *Delphinapterus*[7] Lac.

aa, Superior incisors of one side forming a straight tusk.

Teeth few, deciduous; *Monodon* Linn.

II. Cervical vertebræ mostly coössified.

A. Flippers short, with less than twelve phalanges in the second finger.

a, A dorsal fin.

Teeth few, very robust; palate not grooved; *Orca* Gray.

Teeth medium, numerous, acute; palate not grooved; *Lagenorhynchus*[8] Gray.

Teeth medium, numerous, acute; palate grooved; *Delphinus* Linn.

Teeth numerous; premaxillae elevated in front of nares; palate plane; *Sagmatias*[9] Cope.

Teeth few, easily shed; *Grampus* Cuv.

Teeth compressed, spatuliform; *Phocæna* Cuv.

aa, No dorsal fin.

Teeth numerous, not caducous; *Leucorhamphus*[10] Lillj.

Teeth flat, spatuliform; *Neomeris* Gray.

AA. Flippers long, falciform; index with twelve or more phalanges.

A dorsal fin; teeth few, caducous; *Globiocephalus* Gray.

[7] Beluga Gray.

[8] Tursiops and Prodelphinus Gerv.

[9] Dorsal fin unknown.

[10] Delphinapterus Less. nec Lacep.

But few species of this family are known from terranes of earlier than Pliocene age, and they belong to existing genera. Extinct species of Delphinapterus and Orca have been found in the Italian Pliocene, and of Orca and Globiocephalus in England. In North America the *Delphinapterus orcinus* has been described from the Miocene of North Carolina, and the *D. vermontanus* has left its remains in the so-called Champlain clays of the drainage basin of the St. Lawrence river, which are perhaps of Plistocene age (Plate XXI.).

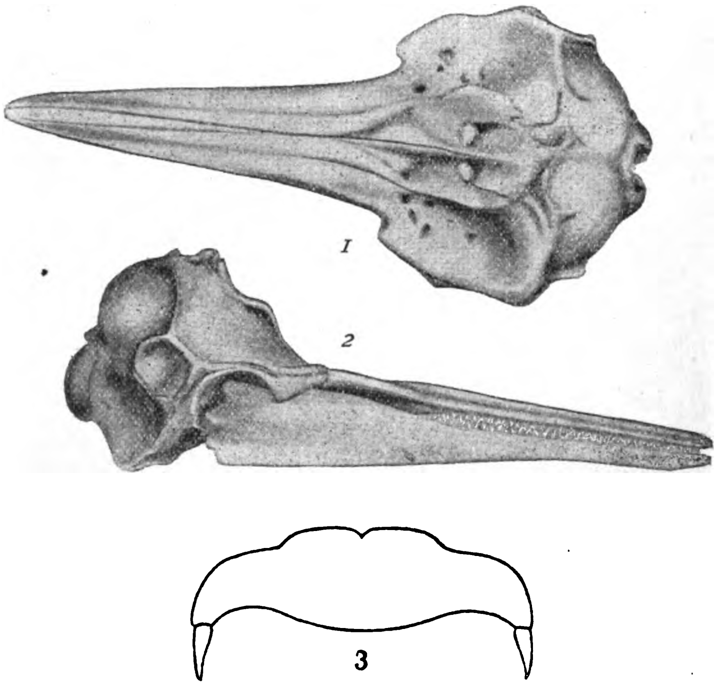


FIG. 6.—*Prodelphinus crotaphiscus* Cope (from type); 1, above, 2, from side; 3, section of muzzle. About one-fifth natural size.

MYSTICETE.

This suborder embraces but a single family, the Balænidæ, whose characters may be summarized as follows:

Nareal canal oblique, overroofed by the short horizontal nasal bones, and underroofed by the elongate ptery-

goids; no longtitudinal or transverse crests of
the skull; *Balænidæ.*

The family of the whalebone whales is represented by many species both recent and extinct. These fall into a number of natural genera, which display several affinities towards different extremes. Thus the fin-backs (Balænoptera) have developed speed through increased length of body; the humpbacks (Megaptera, have developed especial length of the fore limbs, while the right whales (Balæna) have acquired a huge oral cavity and the greatest length of whalebone. The fin-backs pursue and devour great numbers of fishes of small and medium dimensions, and their maw derives an especial capacity for containing them, through the presence of numerous expansible longitudinal folds of its inferior walls. The Balænæ, on the other hand, take in enormous quantities of water, which contains their minute molluscous food, and so enjoy an especial advantage in this direction,

BALÆNIDÆ are abundant in the Miocene, having an origin prior to that of the Dephinidæ. They would seem to have derived their descent from some form allied to the Squalodontidæ, since their nasal bones are more elongated than those of the Odontoceti, and in Plesiocetus the superior cranial bones show some of the elongation of that family. The genera of Balænidæ differ as follows:

I. Frontal and parietal bones elongated on the median line.
Cervical vertebræ distinct; *Plesiocetus* Van Ben.

II. Frontal and parietal bones much abbreviated in the median line.

A, Cervical vertebræ all distinct; fingers four.

a, Numerous gular folds; vertebral canal not enclosed;[11]
No coracoid; manus long; *Megaptera* Gray.[12]
A coracoid; manus not elongate; *Cetotherium* Brandt.[13]
Mandible with a long angle; coronoid large; *Herpetocetus* Van B.

[11] The external characters of Cetotherium and Herpetocetus are unknown.

[12] Poescopia Gray, Burtinopsis Van Ben.

[13] Eschrichtius Gray. Cetotheriophanes Brandt.

aa, Numerous gular folds; vertebral canal enclosed by diapophyses and parapophyses;

Both coracoid and acromion; manus short; a coronoid process; a dorsal fin; *Balænoptera*.[14]

aaa, Only two gular folds;

No dorsal fin; an acromion; *Rhachianectes* Cope.

aaaa, External characters unknown; maxillary bones very narrow.

Manus short; *Mesoteras* Cope.

AA. Cervical vertebræ more or less coössified.

Anterior three cervicals only united; *Palæocetus*, Seeley.[15]

All cervicals coössified; fingers five; no gular plicæ; no coronoid process; *Balæna*, Linn.[16]

The genus Plesiocetus is intermediate in its characters, and as it is generalized in structure, it is probably the ancestral type from which modern Balænidæ have been, by a process of differentiation, derived. Four species have been described from Belgium. The largest of these, *P. brialmontii* Van Ben., was some sixty feet in length; while the *P. brevifrons* Van B. and *P. affine* Van B. were twenty feet and less in length. Cetotherium is more nearly allied to Balænoptera (the finners). The number of species appears to have been considerable, several having been described from Southeastern Europe, one from Italy (*C. capellinii*), and others from Belgium and England. Corresponding species have been found in the Miocene beds of the Eastern States of North America. The *C. cephalus* Cope is about thirty feet in in length, the head being nine feet; and its flippers short. The ear bulla is noticeably compressed, somewhat incurved, and with a nearly parallelogrammic outline from the side; (Fig. 7). The skeleton was found in Charles Co., Maryland. (Plate XXII.) There have been described several species, probably of this genus, from the same region and horizon, of smaller size, the least, *C. pusillum* Cope, having been about fifteen feet in length.

[14] Physalus Gray.

[15] Eubalæna, Macleayius, and Halibalæna Gray; Balænula and Balænotus Van Ben.

[16] The difference between Neobalæna Gray and this genus is not yet known.

Species of Balænoptera and Megaptera occur in the European and probably in the American Miocenes. Those of Belgium correspond in various respects with the existing species. Thus *Balænoptera goropii* is compared by Van Beneden with the common existing finner, *B. musculus;* the *B. borealina* Van B. with the *B. borealis* of the Atlantic; and the *B. emarginata* Owen with the small pike whale, *B. rostrata.* Three species of Belgium and England are referred to the hump-backs, or Megaptera. A remarkable genus is Herpetocetus Van B., of which a single species of rather small size has been found in Belgium.

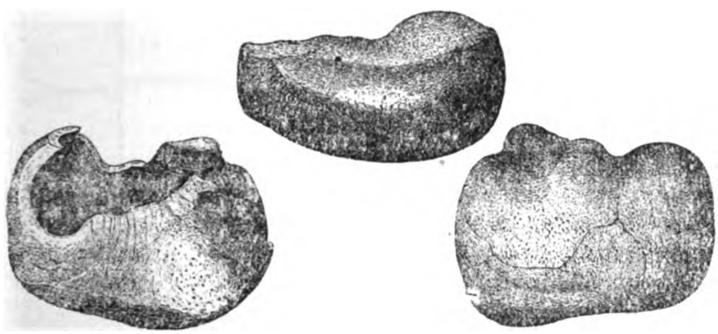


FIG. 7.—*Cetotherium cephalus* Cope, otic bulla. One-half natural size; original; from Miocene of Maryland.

Forms more or less nearly related to the right whales occur in Miocene beds on both sides of the Atlantic. Mesoteras Cope has the characters of the finner whales (Balænoptera) with the narrow maxillary bones of the true Balænæ. A large species with a skull of about eighteen feet in length was found by Prof. W. C. Kerr in Eastern North Carolina, and was named by the writer *Mesoteras kerrianus.* It is distinguished by an enormous thickening of the superciliary part of the frontal bone. The periotic bones are peculiar for their very short proportions, and balæni-form bulla. A small balænoid with only partly coössified cervical vertebræ has been found in the boulder clay of England and named *Palæocetus sedgwickii* by Prof. Seeley. The *P. insignis* Van Ben. from Belgium is also a small species. True Balænæ have been found in various parts of Europe.

In Western Europe three species are recorded from the Miocene, and two from later beds. Of the former, *B. affinis* Owen is similar in size and character to the right whale, *B. mysticetus*, and *B. primigenia* Van Ben. to the shorter headed type represented by the *B. cisarctica* of the middle Atlantic (Plate XXIII.). The *B. balænopsis* Van B. is not over twenty feet in length. In the Plistocene beds of Sweden a true Balæna of the *B. cisarctica* type has been discovered, and has been named *B. svedenborgiana*. It is thus evident that many species of whalebone

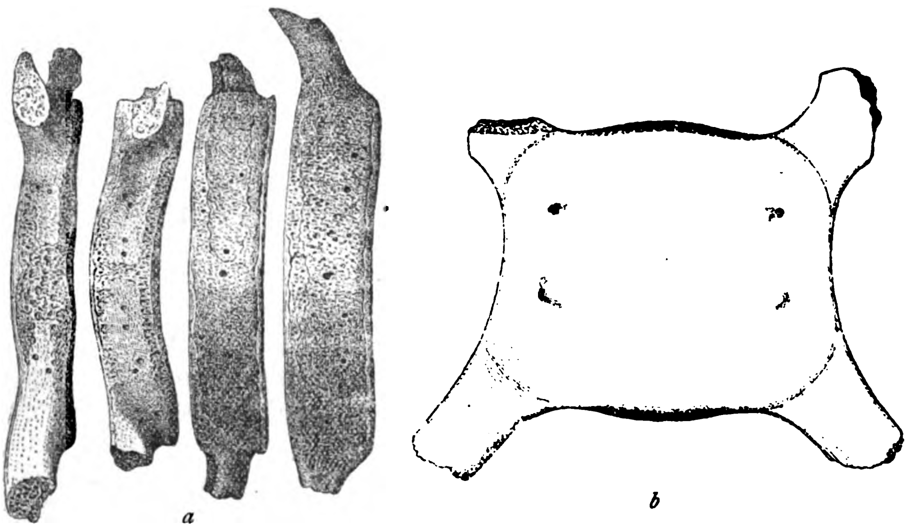


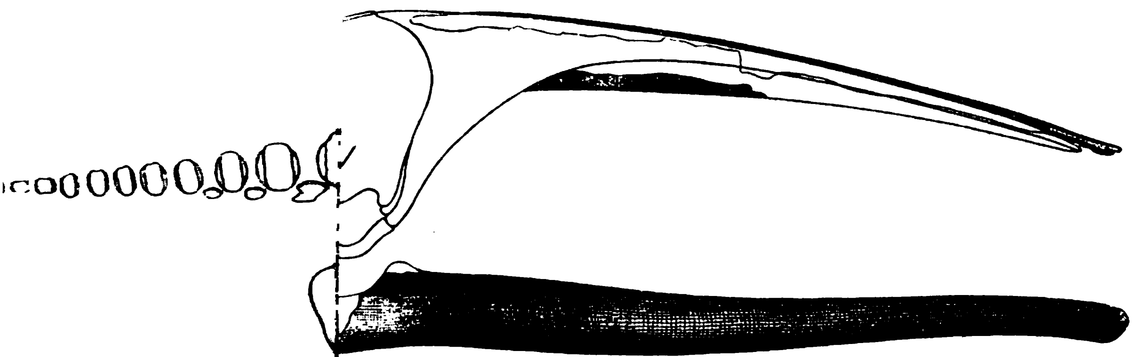
FIG. 8.—*Cetotherium cephalus* Cope, two-fifths natural size; individual represented in Fig. 7. Original; from Miocene of Maryland.

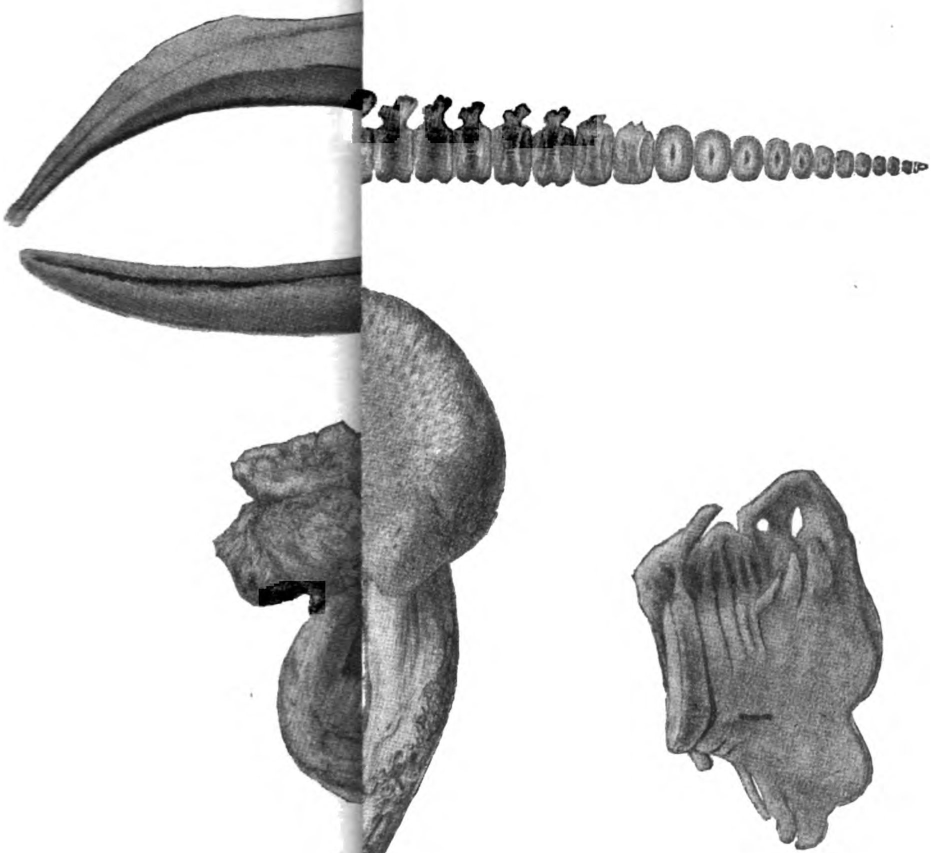
whales have become extinct, some of them in comparatively modern times. Such is the *Cetotherium robustum* Lilljeborg, which is known from a few fragments, not fully fossilized, from an island in the Baltic, and from Cornwall, England.

LIST OF THE EXTINCT CETACEA OF NORTH AMERICA.

BASILOSAURIDÆ, ... 3

Basilosaurus cetoides Owen. Ala., Miss.
Doryodon serratus Gibbes. Ala., Fla.





SQUALODONTIDÆ, ... 6

Squalodon atlanticus Leidy. N. J., Md.
" *vinearius* Leidy. Mass. (Martha's Vineyard.)
" *holmesii* Leidy. S. C.
" *pelagius* Leidy. S. C.
" *pygæmus* Müller. S. C.
" *protervus* Cope. S. C.

PLATANISTIDÆ. 19

Delphinodon mento Cope. S. C.
" *wymanii* Leidy. S. C.
" *venustus* Leidy. S. C.
Lophocetus calvertensis Harlan. Md.
Priscodelphinus grandævus Leidy (=*P. harlani* Leidy). N.J.
" *lacertosus* Cope. Md.
" *gabbii* Cope. Md.
" *uræus* Cope. N. J.
" *ruschenbergerii* Cope. Md.
Zarhachis flagellator Cope. Md.
" *tysonii* Cope. Md.
" *velox* Cope. N. J.
Ixacanthus cœlospondylus Cope. Md.
" *spinosus* Cope. Md.
" *atropius* Cope. Md.
" *conradi* Leidy. Va., Md.
" *stenus* Cope. Md.
Rhabdosteus latiradix Cope. Md.
Agabelus porcatus Cope. N. J.

INCERTÆ SEDIS. 2

Cetophis heteroclitus Cope. Md.
Saurocetus gibbsii Agass. S. C.

PHYSETERIDÆ. 10

Physeter vetus Leidy. N. C.
" *cornutidens* Leidy. N. C., Md.
" *quadratidens* Leidy. N. C.
Hoplocetus obesus Leidy. S. C.
Choneziphius trachops Leidy. S. C.

Choneziphius liops Leidy. S. C.
" *cœlops* Leidy. S. C.
" *macrops* Leidy. S. C.
" *chonops* Leidy. S. C.
Mesoplodon prorops Leidy. S. C.

DELPHINIDÆ. 2

Delphinapterus vermontanus Thompson. Vt., Canada.
" *orcinus* Cope. N. C.
Dephinus occiduus Leidy. Cal.

BALÆNIDÆ, ... 10

Cetotherium pusillum Cope. Md.
" *expansum* Cope. Md.
" *priscum* Leidy. Va.
" *polyporum* Cope. N. C.
" *mysticetoides* Emmons. N. C.
" *cephalus* Cope. Md.
" *leptocentrum* Cope. Va.
Balænoptera palæatlantica Leidy. Va.
" *davidsonii* Cope. Cal.
Mesoteras kerrianus Cope. N. C. —

Total number of species, ... 52

EXPLANATION OF PLATES.

PLATE XX,—*Choneziphius semijunctus* Cope. One-tenth natural size. From photographs of the type in the Museum of Charleston, S. C., taken by Lieut. Vogdes, U. S. A. Fig. 1. Cranium from above; 2, cranium from below; 3, extremity of the mandible, with teeth.

PLATE XXI.—*Delphinapterus leucas* Pallas. One-thirteenth natural size. From a skeleton in the Museum of the Academy of Natural Sciences of Philadelphia, obtained by Dr. I. I. Hayes, from Baffin's Bay. Type of *Beluga concreta* Cope.

PLATE XXII.—*Cetotherium cephalus* Cope. Restoration, one-eighteenth natural size; the portions shaded are the actual specimens of one individual found in the Miocene of Maryland, and now in the Museum of the Academy of Natural Sciences of Philadelphia. Described by E. D. Cope in its Proceedings, 1867, p. 148.

PLATE XXIII.—*Balæna cisarctica* Cope. Type specimen as mounted in the Museum of the Academy of Natural Sciences of Philadelphia; one-thirty-seventh natural size. Fig. 1, side view; Figs. 2, 3, 4, periotic bones from side, end, and below; Fig. 5, cervical vertebræ, oblique inferior view.

THE CONCRESCENCE THEORY OF THE VERTEBRATE EMBRYO.

BY CHARLES-SEDGWICK MINOT.

(Continued from page 516).

The Meroblastic Embryo.—Considerations of practical convenience have led to the custom of distinguishing in the development of meroblastic ova the embryonic from the extra-embryonic portions. The distinction is in reality entirely arbitrary, for the whole of the ovum is included, morphologically speaking, within the body of the embryo. Custom has led to designating the two parts as the embryo and the yolk; the student should be careful not to allow himself to be misled by these terms. In the laboratory it is a general practice to remove the so-called "embryo" from the yolk, and in doing this the entodermic cavity loses its inferior wall, to wit, the entodermic yolk. Let the relations be represented by the accompanying diagram, the embryo being drawn very much too large in proportion to the yolk for the sake of clearness. Suppose the layers to be cut thrôugh on the lines, $x\ x'$; we could then remove the embryonic portion. This is what is actually done in practice. It is very important to understand clearly that the yolk is part of the embryo, and that our sections usually represent only a torso.

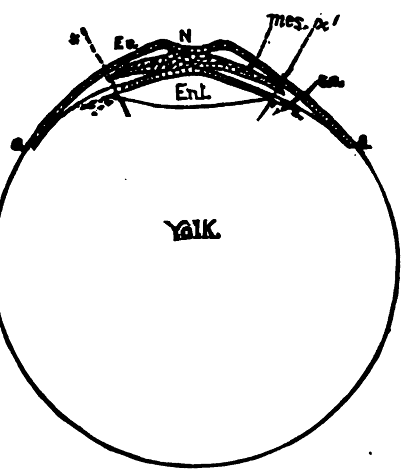


FIG. 10.—Diagram showing the relations of a vertebrate ovum with an embryo in cross-section and a large yolk. *Ec*, ectoderm; *N*, neural groove; *mes*, mesoderm, *s. c.*, segmentation cavity; *Ent*, archenteric cavity; *a, a*, ectodermal vein, where the ectoderm is growing over the yolk.

Structure of the primitive streak.—For our purposes it is convenient to give 1°, a general comparative account; 2°, a more detailed description of the mammalian ovum up to the stage with completed primitive streak.

1°. *Vertebrate primitive streak.*—It is advisable to begin with the consideration of the arrangement as we find it in eggs of marsipobranchs, ganoids, and amphibians, since these eggs are probably more primitive in their mode of development than those of other vertebrates. The points of most importance in my judgment are illustrated in Fig. 11, A and B. In A, we have a section through the middle portion of a partly-formed primitive

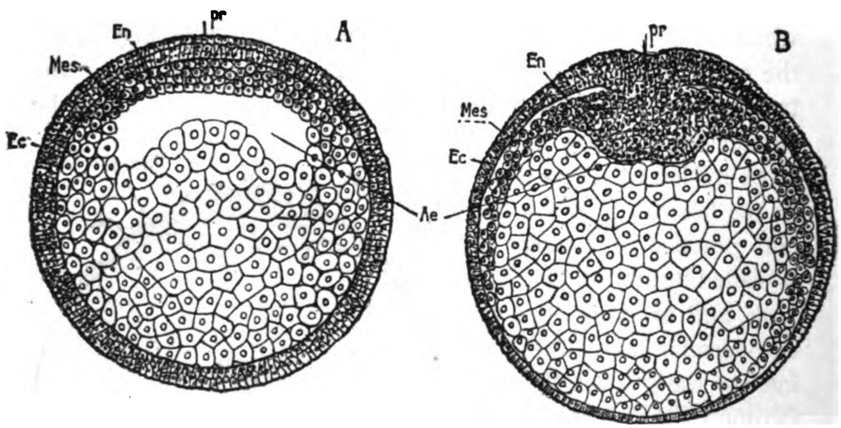


FIG. 11.—Sections of axolotl eggs: after Bellonci. *A*, frontal section somewhat anterior to the blastopore, from an egg in which the archenteron was partly formed, but the anus of Rusconi not delimiated. B, frontal section of an older ovum with well marked but large anus of Rusconi; the section passes just in front of the blastopore. *Ec*, ectoderm; *En*, entoderm; *Mes*, Mesoderm; *Ae*, archenteric cavity; *Pr*, primitive streak.

streak of an axolotl, the streak still requiring considerable additions at its hinder end before attaining its full length; the archenteric cavity, *Ae*, is a large space bounded above by an epithelium, *en*, and below by the large mass of yolk-cells; the two-layered ectoderm, *Ec*, everywhere bounds the section; above the archenteron and below the ectoderm lies the accumulation of cells constituting the primitive streak, *pr;* the lateral prolongations, *Mes*, of the streak represent the commencing mesodermic outgrowths; whether the mesoderm grows out from the primitive streak, and

subsequently expands solely by its own proliferation, or whether it receives at its periphery accretions from the yolk-cells, is uncertain. I am inclined to think that the mesoderm does at first receive additions from the yolk. In B we have a similar section, but of an older stage, and through the hind end of the nearly full-grown streak; the general arrangement is the same as in A; we note the following differences: the primitive streak, *Pr*, is very thick, and composed of numerous small cells, and its lateral mesodermic expansions, *Mes*, extend further around the ovum. In both sections we see that the cells of the primitive streak are not marked off from those of the adjoining entoderm. In a longitudinal section, as is illustrated by that of a sturgeon, Fig. *7*, *ante*, p. 510, we see that the mesoderm or tissue of the primitive streak runs way forward, and is thickest around the blastopore. The disposition of the parts and the appearance of the cells vary in the three groups we are considering, but for our purpose it is unnecessary to describe these secondary differences. The points essential to note are that the primitive streak is formed by mesoderm, which is accumulated along the line, and is thickest around the blastopore, and which spreads laterally between the ectoderm and entoderm; in the axial region the mesoderm is not separated from the entoderm; the blastopore passes through the thick hind end of the streak.

In elasmobranchs the differentiation of the axial tissues begins in the embryonic rim before concrescence takes place, so that while the type affords peculiarly conclusive evidence of concrescence, it is less convenient for the study of the primitive streak since the hind end of the primitive streak is, as it were, divided, being continued as the embryonic rim right and left. The degree of differentiation varies extremely; in Pristiurus the mesoderm grows out from the embryonic rim; in Scyllium the mesoderm grows out, and the differentiation of the notochord begins; in Torpedo (Rückert, *48*, 101) the myotomes appear in the embryonic rim before concrescence, as in Elacate among teleosts. The relations are further complicated by the advance in development of the axial structures while concrescence is going on, so that, as for in-

stance in Pristiurus, Rabl, *44*, 116-129, the notochord may be differentiated while the mesoderm is still developing in the embryonic rim. The precocious changes in the embryonic rim demand especial attention when the origin of the mesoderm is discussed. The ectoderm, as soon as it becomes one-layered, consists of high cylinder cells. As development progresses the ectoderm thins out except at either side of the axial line. The mesoderm arises from the entoderm, close to the ectental line, and is there quite thick, but as it stretches away it thins out. Now, if it be remembered that the ectental lIne becomes the axial line when concrescence takes place it is evident that this mesodermic thickening of the entoderm is in reality axial thickening, and when concrescence takes place it fuses with the corresponding thickening of the opposite side and constitutes an actual axial thickening or true primitive streak; but in elasmobranchs as soon as the anterior axial structures have concresced we find by precocious development that the notochord and medullary groove appears; now, as I have shown elsewhere, the appearance of these structures causes the division of the axial mesoderm into completely separated right and left portions. It is only by keeping the process of concrescence and the precocious development of the parts constantly in mind that we can understand the development in elasmobranchs or compare it rightly with that of other types. From what has been said it is clear that a section of the blastodermic rim from which the mesoderm was just growing out would correspond to half a section of, say, a bird's ovum through the primitive streak, and upon comparison it will be found that all the essential relations are identical.

The structure of the primitive streak in birds has been repeatedly investigated and the subject of much discussion. As the observations of Duval, *17*, *18*, appear to me the most thorough, and as my own preparations have enabled me to confirm many of his statements, I follow in the main that author. Duval's statements have also been verified in many essential points by Zumstein, *69*. Other important authorities to be consulted are Kölliker in both his text-books; His *25*, *28*, *29*, etc.;

Koller, *31;* Disse, *15, 16;* Waldeyer, *64, 65;* M. Braun, *12;* Gasser, *21, 22;* Rauber, *46;* C. Rabl, *44.*

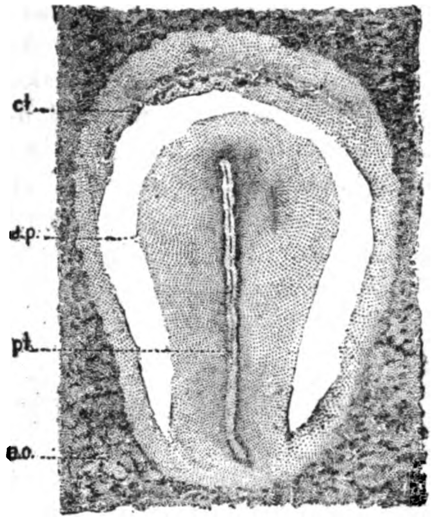


FIG. 12.—Area pellucida of a hen's egg with complete primitive furrow; after Duval. *Ao*, area opaca; *ct*, anterior crescent; *Ap*, area pellucida; *pt*, primitive groove. x 20 diam.

The following description applies to the hen's egg. When the egg is laid the centre of the segmented blasto-disc presents a circular area of lighter color; during the first few hours of incubation this *area pellucida*, as it is called, becomes more distinct; as concrescence goes on the *area pellucida* expands, and the primitive streak appears in it excentrically between the eighth and twelfth hour. By the sixteenth hour the primitive streak has its full length. The rate of development is extremely variable, autumn eggs developing more slowly than spring eggs; the eggs vary also individually, and are moreover much influenced by the temperature of their incubation. For a fuller discussion of these variations see His, *25*, 56–63. Seen from the surface the *area pellucida* with completed streak presents the following features: the *area pellucida*, *ap*, is considerably elongated and somewhat pear-shaped, being widest at the anterior end of the primitive groove, *pt;* this groove is well marked as a narrow and shallow furrow, which begins some distance from the anterior edge of the area, and ends just before reaching the posterior edge of the area; the front end of the furrow usually bends slightly to the left, but not invariably, as Koller and Rabl have maintained, for it sometimes bends to the right or is quite straight; a line of granules is sometimes noticeable above the primitive groove; they were seen by Dursy, *l. c.*, and are called by Duval, *17*, p. 15, the *filament épiaxial*, compare Gasser, *14*. The

portion of the *area pellucida* immediately around the primitive groove appears slightly darker than the rest. The anterior portion of the pellucida is further distinguished by the anterior crescent, *ct*, the "vordere Aussenfalte" of His, *25*, and other German writers. The anterior crescent is a temporary appearance due, according to Duval, to a series of folds of the entoderm, which forms a curving row of shallow pockets, that, shining through, mark out the crescent. The crescent disappears a little later, and there arises, nearly if not quite in its place, a new fold, the amniotic. The similarity of position has led to the anterior crescent being identified by some authors with the true amniotic fold.

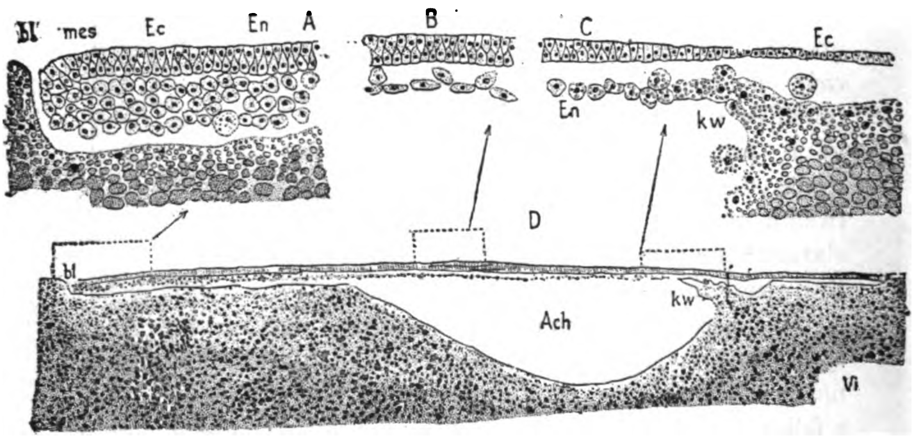


FIG. 13.—Longitudinal section of the region of the primitive streak of a hen's ovum incubated six hours; after Duval. *D*, general view magnified about 40 diameters; *A, B, C*, details of *D*, with higher magnification; *Ec*, ectoderm; *Mes*, mesoderm; *Ent*, entoderm; *bl*, blastopore; *k w*, germinal wall (keim wall); *Ach*, archenteric cavity.

Longitudinal and transverse sections are very instructive. We begin with the examination of a *longitudinal section* of a somewhat younger stage, in which the blastopore is open. Later the ectoderm closes behind the primitive streak, as already stated, and spreads backward over the yolk. The section shows that the yolk is not divided into cells, although nuclei are scattered through it; the nuclei are represented as black dots in *A* and *C*. The cavity of the archenteron, *Ach*, is enlarged by the formation of a deep pit in the yolk, while the posterior half of the cavity

remains a narrow fissure between the cellular entoderm, *Ent*, and the yolk; the archenteron communicates with the exterior by the blastopore, *bl.* The entoderm is a loosely put together stratum of cells, which passes over anteriorly into a ridge of the yolk in which cells are being produced around the already accumulated nuclei; this ridge, *k w*, is the germinal wall. Posteriorly the cell layers are much thicker, *A*; the ectoderm is clearly differentiated from the underlying cells, which are all more or less alike, though they represent both the entoderm and mesoderm. From this connection and from the fact that the connection between the ectoderm and mesoderm, which is so well known to exist after the primitive streak has attained its full

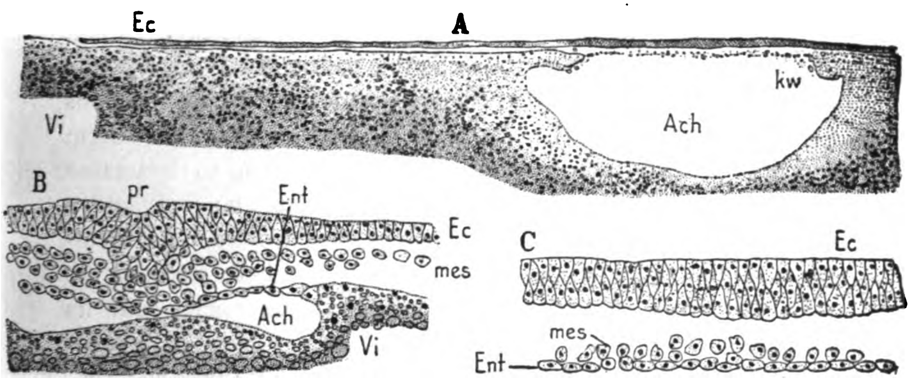


FIG. 14.—Transverse sections of a germinative area with half formed primitive streak; after Duval. *A*, through the anterior region of the area pellucida; *B*, through the primitive streak; *C*, part of *A* enlarged; *Ec*, ectoderm; *Mes*, mesoderm; *Ent*, entoderm; *k w*, germinal wall (Keimwall); *Ach*, archenteric cavity; *Pr*, primitive groove; *Vi*, yolk.

length, Duval concludes that the mesoderm arises primitively from the entoderm. *Transverse sections* afford additional information. The accompanying figure, 14, represents cross sections of a germinal area the primitive streak of which has attained about one-half its full length. The first section, Fig. 14, *A*, passes through the anterior region of the area pellucida; it shows the large cavern, *Ach*, of the archenteron hollowed out in the yolk; the entoderm, *Ent*, above the cavity is a thin layer of cells, connected laterally with a projecting shelf of yolk, *k w* (the *bourrelet entodermo-vitellin* of Duval), which is rich in nuclei, and subse-

quently expands very far and acquires a more cellular character; this shelf is the commencement, therefore, of the *Keimwall* of German writers. Immediately above the entoderm and intimately connected with it are a few cells which belong to the mesoderm, *C, Mes;* the ectoderm is quite thick, *C, Ec*, and consists of high columnar cells; towards its periphery the ectoderm thins out, and its edge rests upon the yolk, with which it has no connection. In the region of the primitive streak, Fig. 14, *B*, the fundamental relations are the same, but there are important differences to note. The entodermic cavity, *Ach*, is very much smaller; the mesoderm is much thicker, and in the axial region fuses with both the ectoderm and entoderm, thus forming the *Achsenstrang* (axial cord) of German writers; the mesoderm also spreads out over the yolk far beyond the archenteric cavity, about one-third of the way from the axial line to the distal edge of the ectoderm; the ectoderm is disposed about as in the previous section, except that in the centre it merges into the mesoderm and presents externally a small notch corresponding to the section of the primitive groove. There appears to me no satisfactory evidence that the mesoderm receives, as some writers have maintained, peripheral additions from the yolk. In both sections the yolk under the blastoderm contains numerous nuclei near its surface.

Modifications very soon ensue in the Sauropsida (birds and reptiles) by which the disposition of the mesoderm is considerably changed, especially in three respects, namely: by the appearance of the so-called head process (Kopffortsatz), by the axial connection of the mesoderm with the ectoderm, and by its losing in part its connection with the mesoderm. During these changes the archenteron expands rapidly, the archenteron expands rapidly, the entoderm becomes very thin in the region of the are apellucida, and passes more and more abruptly, as development progresses, into the so-called germinal wall of the area opaca; finally the ectoderm becomes thinner peripherally; so that the axial thicker part is gradually marked off more and more abruptly. Sections of a stage with a primitive groove at its maximum,—a stage which is usually found towards the end of the first day of incu-

bation,—show three changes clearly. A cross section through the area opaca in front of the area pellucida shows the thin ectoderm, the thick cellular entoderm overlying the archenteric cavity and charged with yolk granules; the entodermic nuclei are very variable in form and irregular in distribution; the cell boundaries are indistinct. There is no mesoderm. A cross section near the front of the area pellucida likewise shows only ectoderm and entoderm; the former is a high cylinder epithelium over the area pellucida and thins out towards the opaca on each side; the latter is a thin layer over the area pellucida, and passes quickly but not abruptly into the very thick yolk-bearing entoderm (or Keimwall) of the area opaca. Sections a short distance in front of the primitive groove show that the head process (*Kopffortsatz*) is a forward prolongation of the primitive streak and consists of an

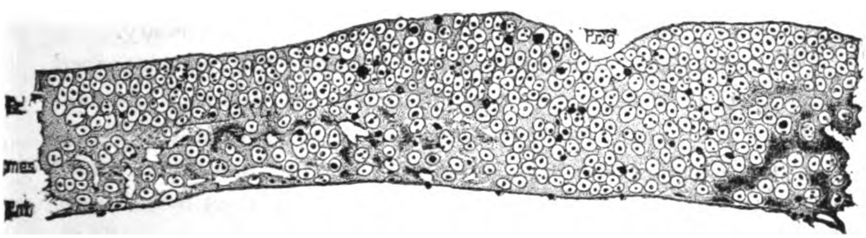


FIG. 15.—Transverse section of the anterior region of a fully developed primitive streak of a hen's ovum. *Ec*, ectoderm; *mes*, mesoderm; *Ent*, entoderm; *Pr.g*, primitive groove. The black dots represent yolk granules.

axial accumulation of the mesodermic cells, fused with the entoderm, and having broad extensions sideways to form the mesoderm beeween the outer and inner germ-layers; the lateral portions of the mesoderm have no connection with the outer germ-layers, and at its distal edge the mesoderm thins out and rests upon the entoderm of the opaca, but without being connected with it; I cannot find any satisfactory evidence that it receives any additions from the opaca entoderm, as many authors have maintained. The ectoderm in the region of the Kopffortsatz resembles that further forward, but it very soon shows a faint median furrow, the so-called dorsal groove (*Rückenrinne*), which is the commencement of the medullary groove. In the anterior half of the primitive streak the relations are similar to those in the head process, ex-

cept that the ectoderm shows the primitive groove, Fig. 15, and is fused with the axial cord (*Achsenstrang*) of the mesoderm, so that in the axial region the three layers are united. In the posterior region of the primitive groove the connection of the mesoderm with the inner germ layer is dissolved, but the connection with the entoderm is retained. Behind the primitive groove the mesoderm extends, but lies free between the ectoderm and entoderm. To recapitulate:—There is a long axial mesodermic thickening, which has the primitive groove over its posterior two-thirds; the thickening in front of the groove is united with the entoderm and is called the head process; the thickening under the front half of the groove is united with both the ectoderm and entoderm; the thickening under the hind half of the groove is united only with the entoderm; it is to be remembered that the mesoderm arises from the entoderm, and its connection with the ectoderm is, it seems to me, to be considered secondary.

A comparative examination of the primitive streak, as described for various classes in the preceding pages, shows that it has a remarkable uniformity of organization. In all types it consists of an axial accumulation of mesodermic cells; this mesodermal axial cord overlies the archenteron, and sends out mesodermic tissue in a widening sheet between the ectoderm and entoderm, headwards, sideways, and backwards; the mesoderm is thickest posteriorly, *i. e.*, in the region of the blastopore; when it first appears it is intimately connected with the entoderm except in the neighborhood of the blastopore, where both entoderm and mesoderm unite with ectoderm. The mesoderm constitutes an axial mass, and offers no trace of a bilateral division or origin. Such a division is produced secondarily by the meeting of the medullary and notochordal grooves. The ectoderm in the region of the primitive streak consists of high cylinder cells, but it gradually thins out toward the embryonic rim. The entoderm on the dorsal side of the archenteron consists of discrete cells, which soon acquire a distinctly epithelial arrangement; laterally and in front it passes over into the yolk, which may be cellular or a multinucleate mass. These features recur in all the types we have studied, though the variations are very great. In the imme-

diately following stages there is a rapid expansion of the mesoderm, in all directions, and also an expansion of the archenteric cavity, which is especially noticeable in meroblastic ova. The relations of the blastopore are discussed below.

2°. *Mammalian primitive streak.*—The description of the primitive streak has to be preceded by an account of the changes in the blastodermic vesicle from the close of segmentation to the appearance of the primitive streak.

Mammalian blastodermic vesicle.—After the close of segmentation we find that the inner mass becomes flattened out, and in the region it occupies we can distinguish three layers of cells, as previously described, *first*, counting from the outside the thin layer of cells known as Rauber's "Deckschicht;" *second*, a middle layer of cylindrical cells, which becomes the ectoderm; *third*, an inmost layer of thin flattened cells, which belong to the entoderm; the "Deckschicht" continues round the whole vesicle as a single layer; the others layers do not so continue.

The next step in development is the formation of a second layer which spreads out in all directions from the region of the inner mass; hence as far as the new layer reaches the blastodermic vesicle becomes two-layered. Meanwhile the "Deckschicht" disappears, leaving two layers in the region of the inner mass; it is to be remarked that the "Deckschicht" is retained in certain rodents, undergoing special modification as described in the section on inversion of the germ-layers. The stage in which the vesicle is partly two-layered, while the "Deckschicht" is still present, is exemplified in Fig. 16.

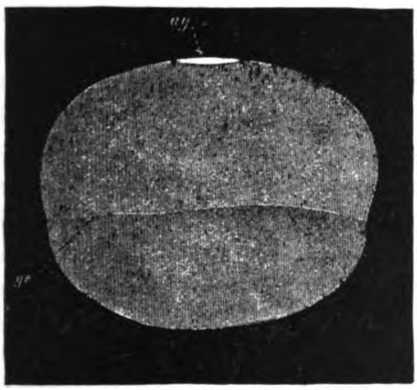


FIG. 16.—Blastodermic vesicle of a rabbit of seven days. *ag*, area germinativa or embryonic shield; *ge*, line, above which the vesicle is two layered.

Blastocyst of the rabbit of six days.—The development is ex-

ceedingly variable, so that exact times cannot be given. The general appearance is illustrated by Fig. 16. from Kölliker. The vesicle figured was 4.4 mm. in length; the envelopes of the ovum are not shown, though they were still present; at the upper pole is the small embryonic shield, corresponding in position to the inner mass; it is marked out by the greater thickness of the walls of the vesicle; the developing second layer extends over more than half the vesicle, reaching to the line *ge*.

The following is a summary of Ed. van Beneden's description, *2*, 185-200, of the blastodermic vesicle of a rabbit at 6 days, 1½ hours after coitus. The vesicle measured 3.2 mm. in diameter; it was nearly spherical; the wall of one hemisphere consisted of one layer of cells; the other hemisphere had two layers of cells, and besides in its central portion a third layer intervening between the other two. The area with three layers van Beneden designates as the *tache embryonnaire;* it showed no trace of the primitive streak; it was oval in outline, and had one point, which the author identifies as Hensen's knot, where the layers adhere together closely. Transverse sections show that the outermost layer of cells is a low cylinder epithelium, which at the edge of the area passes into a thin epithelium quite abruptly; it corresponds to Rauber's "*Deckschicht*," and has been said by him to flatten out and disappear, leaving the cells underneath as the outer layer of the embryonic vesicle in later stages, compare the following paragraph. The cells of the innermost layer are thin and wide; they are called the hypoblast (entoderm) by van Beneden; the cells themselves have round nuclei, around each of which is accumulated a court of granular protoplasm; the adjacent courts are connected by a coarse meshwork of protoplasmic threads; treatment with nitrate of silver brings out the cell boundaries, and divides the reticulum into polygonal areas. The cells of the present outermost layer have distinct boundaries and contain granules, and long bacilliform bodies, which van Beneden saw also in the fresh specimens, and found to be constant appearances. Similar bodies are found in the germinal vesicles of sheep, and are held by Bonnet, *10*, to be derived from the uterine milk; the rabbit is not known to have uterine milk. The histo-

logical peculiarities of these two layers remain about the same from the fifth to the eighth day. The middle layer consists of rounded cells with numerous granules; seen from the surface their diameter is greater than that of the cells outside them, but much less than that of the cells underlying them. While we know that the middle layers are ectodermal, it is uncertain whether the inner layer is really entodermal or really belongs with the two outer layers as part of the primitive blastoderm or ectoderm; in the latter case, the true entoderm of the archenteron must arise later, as we must consider probable also for the reason that the primitive streak is not yet formed.

HISTORY OF GARDEN VEGETABLES.

BY E. L. STURTEVANT.

(Continued from p. 332.)

ROCKET SALAD. *Brassica eruca* L.

THIS strong and to most persons offensive plant has been long under culture, and is even now highly esteemed by the Greeks and Turks, who prefer it to any other salad.[1] It was cultivated by the ancient Romans. Albertus Magnus[2] in the thirteenth century speaks of it in gardens; so also does Ruellius[3] in 1536, who uses nearly the present French name, *roqueta*. In 1586 Camerarius[4] says it is planted most abundantly in gardens. In 1726 Townsend[5] says it is not now very common in English gardens, and in 1807 Miller's Dictionary[6] says it has been long rejected. It was in American gardens in 1854 or earlier,[7] and is yet included by Vilmorin[8] among European vegetables.

[1] Walsh. Hort. Trans., VI., 53.
[2] Albertus Magnus. De Veg., Jessen Ed., 1867, 507.
[3] Ruellius. De Nat. Stirp., 1536, 513.
[4] Camerarius. Epit., 1586, 306.
[5] Townsend. Seedsman, 1726, 18.
[6] Miller's Dict., 1807.
[7] Brown. Pat. Off. Rept., 1854.
[8] Vilmorin. Les Pl. Pot., 1883, 541.

Rocket or *Rocket Salad* is called in France, *roquette, cresson de fontaine, salade de vingt-quatre heures;* in Germany, *rauke, senfkohl;* in Flanders, *krapkool;* in Holland, *rakette kruid;* in Italy, *ricola, ruca, ruccola, ruchetta, rucola;* in Spain, *jaramago, oruga, raqueta;* in Portugal, *pinchao;*[8] in Greece, *aromatos, euzomaton, roka;* in Egypt, *djaerdjir;*[9] in Arabic, *gergyr.*[10]

ROSEMARY. *Rosmarinus officinalis* L.

This aromatic herb, whose leaves are sometimes used for seasoning, had many virtues ascribed to it by Pliny, and it is also mentioned by Dioscorides and Galen. It was also familiar to the Arab physicians of Spain in the thirteenth century, and is mentioned in an Anglo-Saxon herbal of the eleventh century.[11] The first notice I find of its use as a condiment is by Lignamine in 1475,[12] who describes Rosemary as the usual condiment with salted meats. In 1783 it is described by Bryant[13] as so common in gardens as to be known to every one, and it also finds mention in nearly all the earlier botanies. In 1778 Mawe[14] names four varieties, the common narrow-leaved, broad-leaved, the silver-striped, and gold-striped leaved. It was in American gardens in 1806 or earlier.

Rosemary is called in France, *romarin, encensoir, herbe aux couronnes;* in Germany, *rosmarin;* in Flanders and Holland, *rozemarijn;* in Denmark, *rosmarin;* in Italy, *rosmarino;* in Spain, *romero;* in Portugal, *alecrim;*[15] in Greece, *dendrolibanon;*[16] in Arabic, *klyl, aselban,*[17] *vkleelul-jilbal, hasalban-achsir;*[18] in India, *bubureeah,*[19] in Tagalo, *romero.*[20]

[9] Pickering. Ch. Hist., 281.
[10] Delile. Fl. Aeg. Ill.
[11] Pharmacographia, 1879, 488.
[12] Lignamine. De Conserv. Sanitatis, 1475, c. 81, quoted from Pharmacog., l.c.
[13] Bryant. Fl. Diet., 1783, 141.
[14] Mawe. Gard., 1778.
[15] Vilmorin. Les Pl. Pot., 541.
[16] Hogg. *Hooker's Jour. of Bot.*, I., 134.
[17] Delile. Fl. Aeg., Ill.
[18] Birdwood. Veg. Prod. of Bomb., 65, 242.
[19] Speede. Ind. Handb. of Gard., 186.
[20] Pickering. Ch. Hist., 459.

RUE. *Ruta graveolens* L.

The leaves of Rue, although of a strong odor, disagreeable to some people, are occasionally used for seasoning, and the Italians and Greeks are said to eat them in salads. It was formerly in request, and the Romans seem to have appreciated it highly; and Pliny[21] devotes more than a just space in enumerating its virtues, and speaks of wine flavored with Rue as among the viands distributed to the populace by a Roman consul. In the book on cookery by Apicius[22] in the third century we find Rue used among the condiments. In the thirteenth century Albertus Magnus[23] describes Rue among garden esculents, and praises it. At a later period its garden culture is mentioned in the early botanies and in the earlier works on gardening. In 1806 McMahon[24] mentions it among the medicinal herbs for American gardens. Two varieties, the broad-leaved and the narrow-leaved, were known to Burr[25] in 1863, to Mawe[26] in England in 1778, and apparently to Tragus[27] in Germany in 1552.

Rue or *herb grace* is called in France, *rue;* in Germany, *raute*, *weinraute;* in Holland, *wijnruit;* in Spain, *ruda;*[28] in Norway, *viinrude;*[29] in Italy, *ruta;* in Greece, *peganos;*[30] in Arabia, *schedab;*[31] in India, *satoora, aloodu;*[32] in Japan, *mats kase so.*[33]

RUTA-BAGA. *Brassica napo-brassica.*

The Ruta-bagas of our gardens include two forms, the one with white flesh, the other with yellow. The French call these two classes *chou-navets* and *Ruta-bagas*. The *chou-navet* or *Brassica napo-brassica communis* A. P. DC. has either purple or white

[21] Pliny. Lib., XX., c. 51; XIX., 45.
[22] Apicius. De Opsonibus, Ed. 1709.
[23] Albertus Magnus. De Veg., Jessen Ed., 1867, 148.
[24] McMahon. Am. Gard. Kal., 1806.
[25] Burr. Field and Gard. Veg., 1863, 573.
[26] Mawe. Gard., 1778.
[27] Tragus. De Stirp., 1552, 68.
[28] Vilmorin. Les Pl. Pot., 542.
[29] Schubeler. Culturpf., 117.
[30] Pickering. Ch. Hist., 271.
[31] Forskal. Fl. Aeg. Arab., CXI.
[32] Speede. Ind. Handb. of Gard., 185.
[33] Thunberg. Jap., 180.

roots; the *Ruta-baga* or *B. napo-brassica Ruta-baga* A. P. DC. has a more regular root, round or oval, yellow both without and within.[34] In English nomenclature, while now the two forms are called by a common name, yet formerly the first constituted the *turnip-rooted cabbage.* In 1806 the distinction was retained in the United States, McMahon[35] describing the *turnip-rooted cabbage* and the *Swedish turnip* or *Roota-baga.* As a matter of convenience we shall describe these two classes separately.

The first description of the white-rooted form that I note is by Bauhin[36] in his Prodromus, 1620, and it is named again in his Pinax,[37] 1623, who calls it *napo-brassica.* In 1686, Ray[38] apparently did not know it in England, as he quotes Bauhin's name and description, which states that it is cultivated in Bohemia and is eaten, but Morison[39] in 1669 catalogues it among the plants in the royal gardens. In France it is named by Tournefort,[40] in 1700, *Brassica radice napiformi* or *chou-navet.* In 1778 these were called in England *turnip cabbage with the turnip underground,* and in the United States, in 1806, *turnip-rooted cabbage,* as noted above.[35] There are three varieties described by Vilmorin,[41] one of which is purple at the collar, and apparently these same varieties are named by Noisette[42] in 1829, and the white, and the red-collared by Pirolle[43] in 1824, under the names *chou-navet, chou turnip,* and *chou de Lapland.* This class, as Don[44] says in 1831, is little known in English gardens, though not uncommon in French horticulture.

The Ruta-baga is said by Sinclair, in the account of the system of husbandry in Scotland, to have been introduced into Scotland about 1781–2, and a quotation in the *Gardeners' Chronicle,*[45] says

[34] Decandolle. Mem. on Brassica, 1821, 25.
[35] McMahon. Am. Gard. Kal., 1806.
[36] Bauhin. Prodromus, 1671, 54.
[37] Bauhin. Pin., 1623, III.
[38] Ray. Hist., 1686, 797.
[39] Morison. Hort. Reg. Bles., 1669, 31.
[40] Tournefort. Inst., 1719, 219.
[41] Vilmorin. Les Pl. Pot., 142.
[42] Noisette. Man., 1829, 349.
[43] Pirolle. L'Hort. Fran., 1824.
[44] Don. Gar. and Bot. Dict., I., 241.
[45] Gard Chron., 1853, 346.

it was introduced into England in 1790. I find no earlier references. It is mentioned in 1806 by McMahon as in American gardens, and in 1817 there is a record of an acre of this crop in Illinois.[46] The vernacular names all indicate an origin in Sweden or Northern Europe. It is called *Swedish turnip* or *Roota-baga* by McMahon in 1806, by Miller's Dictionary in 1807, by Cobbett in 1821, and by other authors to the present time. Decandolle in 1821 calls it *navet jaune*, *navet de Swede*, *chou de Laponie*, and *chou de Suede*. Pirolle in 1824 *Ruta-baga* or *chou navet de Suede*, as does Noisette in 1829. In 1821 Thorburn calls it *Ruta-baga* or *Russian turnip*, and a newspaper writer in 1835[47] calls it *Ruta-baga*, *Swedish turnip*, *Lapland turnip*. The foreign names given by Don in 1831 include many of the above-named and the Italian *navone di Laponia*. Vilmorin,[41] in his Les Plantes Potageres, 1883, describes three varieties, one with a green collar, one with a purple collar, and a third which is early.

The modern names for the species are: In English, *Swedish turnip*, *Ruta-baga*; in England also, *turnip-rooted cabbage and Swede*; in France, *chou-navets*, *chou-rave en terre*, *chou turnep*; in Germany, *kohlrube*, *erd-oder unter-kohlrabi*, *wruekenrube*; in Flanders, *steekrapp*; in Holland, *koolraapen onder den grond*; in Denmark, *roe*; in Italy, *cavalo navone*; in Spain, *col nabo*, *nabicol*; in Portugal, *couve nabo*;[41] in Sweden, *rot-kal*;[48] in India, *lal shulghum*.[49]

SAFFRON. *Crocus sativus* L.

This plant is hardly deserving of mention, as its presence in the kitchen-garden is scarcely ever noted. Saffron, however, as a medicine, condiment, perfume, or dye, has been highly prized by mankind from a remote period. Under the Hebrew name, *carcom*, the plant is alluded to by Solomon; and as *krohos* by Homer, Hippocrates, Theophrastus, and Theocritus. Virgil and Columella mention it, and Cilicia and Sicily are both alluded to by Dioscorides and Pliny as localities celebrated for this drug.

[46] Pat. Of. Rept., 1854, 198.
[47] *Maine Farmer*, May 15, 1845.
[48] Tengborg. Hort. Culin., 1764.
[49] Speede. Ind. Handb. of Gard., 138.

Throughout the middle ages frequent notices are found of its commerce and cultivation. A most interesting resùmé of the history of Saffron may be found in the Pharmacographia by Fluckiger and Hanbury.

Saffron is called in France, *safran;* in Germany, *saframpflance;* in Italy, *zafferano;* in Spain, *azafran;*[50] in Greece, *krokos;* in Egyptian, *methaio;*[51] in Arabic, *koorkum zafran;* in Burma, *thauwen;* in Hindustani, *zofran keysur;* in Malay, *saffaron coonyer;* in Persian, *kerkum;* in Sanscrit, *kasmirajamma, kunkuma;* in Tamil, *khoongoomapoo;* in Telegu, *khoonkoomapoo, kukuma.*[52]

SAGE. *Salvia officinalis.*

This is one of the most important occupants of the herb garden, being commonly used for seasoning, and also in domestic medicine. It has been under cultivation from a remote period, and is considered to be the *elelisphakos* of Theophrastus, the *elelisphakon* of Dioscorides, the *salvia* of Pliny, and its medicinal virtues are noted by Oribasius, and others of the early writers on medicine. In the middle ages it found frequent mention, as by Albertus Magnus in the thirteenth century, and the plant and its uses are noticed in nearly all of the early botanies. Although but one variety is now grown in our gardens, yet formerly a number of sorts are noted, the red, green, small, and variegated being named by Worlidge[53] in 1683. Sage was in American gardens in 1806[54] and doubtless long before, and six varieties are described by Burr[55] in 1863, all of which can perhaps be included among the four mentioned in 1683, and all by Mawe in 1778.

Sage is called in France, *sauge officinale, grande sauge, herbe sacree;* in Germany, *salbei;* in Flanders and Holland, *salie;* in Italy, *salvia;* in Spain, *salvia;* in Portugal, *molho;*[56] in Norway,

[50] Vilmorin. Les Pl. Pot., 543.
[51] Pickering. Ch. Hist., 115.
[52] Birdwood. Veg. Rod. of Bomb., 88, 24.
[53] Syst. Hort., by J. W. Gent, 1683, 218.
[54] McMahon. Am. Gard. Kal., 1806.
[55] Burr. Field and Gard. Veg., 1863, 438.
[56] Vilmorin. Les. Pl. Pot., 546.

salvie;[57] in Greece, *sphakos*, *sphákelos*;[58] in India, *seesta*, *salbeea*;[59] in Hindustani, *salbia*.[60]

SALSIFY. *Tragopogon porrifolium* L.

In the thirteenth century Albertus Magnus[61] describes a wild plant, *Oculus porce* or *flos campi*, which commentators identify with the salisfy, as having a delectable root, which is eaten, but he makes no mention of cultivation. It is described, but apparently not under kitchen garden culture by Matthiolus in 1570 and 1598,[62] but not mentioned by him in 1558, when he refers to the yellow-flowered species; there is no mention of culture by Camerarius[63] in 1586, but in 1587 Dalechamp[64] says it is planted in gardens. In 1597 Gerarde[65] describes it, but apparently as an inmate of the flower garden. In 1612 Le Jardinier Solitaire speaks of it as under kitchen garden culture in France, and in 1616 Dodonaeus,[66] J. Bauhin[67] in 1651, and Ray[68] in 1686, refer to it as apparently cultivated. After this period its culture seems to have been quite general, as it is referred to in the works on gardening, beginning with Quintyne, in 1693. It was in American gardens prior to 1806. There are no varieties, and the drawings of an early period indicate as improved a root as is now commonly grown.

The *Salisfy* or *oyster plant* is called in France, *salsifis*, *cercifix*, *salsifix blanc*, *barberon*; in Germany, *haferworzel*; in Flanders, *haverwortel*; in Denmark, *havrerod*; in Italy, *barba di becco*, *salsifia*; in Spain, *salsifi blanco*; in Portugal, *cercifi*; in Brazil,

[57] Schubeler. Culturpfl., 88.
[58] Hogg. *Hook. Jour. of Bot.*, 1, 134.
[59] Speede. Ind. Handb., of Gard., 182.
[60] Birdwood. Veg. Prod. of Bomb., 66, 242.
[61] Albertus Magnus. De Veg., Jessen Ed., 1867, 546.
[62] Matth. Comm., 1570, 379; Op., 1598, 410; Com., 1558, 270.
[63] Camerarius. Epit., 1586, 313.
[64] Hist. Gen. Lugd., 1587, 1079.
[65] Gerarde. Herb., 1597, 596.
[66] Dodonaeus. Pempt., 1616, 256.
[67] J. Bauhin. Hist., II., 1059.
[68] Ray. Hist., 1686, 252.

cercefin;[69] in Greece, *trihoura*;[70] in Norway, *havrerod*;[71] in the Mauritius, *salsifis*.[72]

The yellow-flowered species, *Tragopogon pratense* L.[73] seems formerly to have been cultivated. The use of the root is noted by Matthiolus in 1558. In 1597 Gerarde notes it as a wild plant of England. In 1640 Parkinson recommends it as excellent for the table, and cultivated for this purpose. Vilmorin, in 1883, also mentions a yellow-flowered form as under occasional culture, but he does not refer it decisively to this botanical species.

SAMPHIRE. *Crithmum maritimum* L.

The shoots of this seaside plant are pickled in vinegar, and it is even an object of garden culture for this purpose. The first mention of its culture that I find is by Quintyne,[74] in France, in 1690; it is again mentioned by Stevenson,[75] in England, in 1765; and its use as a pot-herb by the poor, as well as a pickle, is noticed by Bryant[76] in 1783. It is noticed in American gardens in 1821.[77]

Samphire, *Sampier*, *Sea Fennel*, or *Sea Samphier* is called in France, *perce-pierre*, *baeile*, *christe marine*, *crete marine*, *fenouil des marais*, *fenouil marin*, *herbe de St. Pierre*, *passe-pierre*, *saxifrage maritime*; in Germany, *meer-fenchel*, *steinbrech*; in Flanders and Holland, *zeevenkel*; in Italy, *bacicci*, *erba san-pietro*, *sassifraga*; in Spain, *hinojo marino*, *pasa piedra*; in Portugal, *funcho marino*;[78] in Greece, *almura* or *kretamon*.[79]

SAVORY. *Satureja* sp.

But two species of Savory are now included among the cultivated sorts, but it is not long since that four species occurred

[69] Vilmorin. Les. Pl. Pot., 543.
[70] Pickering. Ch. Hist., 625.
[71] Schubeler. Culturpfl., 85.
[72] Bojer. Hort. Maur., 190.
[73] Miller's Dic., 1807. McIntosh. Book of the Gard., II, 228.
[74] Quintyne. Comp. Gard., 1693, 105.
[75] Stevenson. Gard. Kal., 1765, 102.
[76] Bryant. Fl. Diet., 1783, 136.
[77] Cobbett. Am. Gard., 1821.
[78] Vilmorin. Les Pl. Pot., 402.
[79] Pickering. Ch. Hist., 294.

in our books on garden esculents, and yet another by earlier writers. This class of aromatics were known to the ancient Romans, and were referred to under the name of *satureia cunila* and *thymbra*.

The European names given to the *Savory* are: In France, *sarriette;* in Germany, *die saturei;* in Holland, *keul;* in Italy, *sautoreggia;* in Spain, *ajedrea;* in Portugal, *segurelha;* in Russia, *tschaber;* in Denmark, *saer;* in Poland, *ozabi.*[80]

Satureja hortensis L.

This species seems to be the *satureja* of Palladius[81] in the third century, and of Albertus Magnus[82] in the thirteenth, and is mentioned in England by Turner[83] in 1538, which would indicate its presence there at this date. It was also well known to all the earlier botanists, and is mentioned as a common pot-herb by all the earlier writers on gardening. In 1783 Bryant[84] says that besides being used as a pot-herb, it is frequently put into cakes, puddings, sausages, etc. It was in American gardens in 1806 or earlier,[85] and as an escape from gardens is now sparingly found in Ohio, Illinois, Nevada, etc.[86] The whole plant is highly odoriferous, and it is usually preferred to the other species.

Summer Savory is called in France, *sarriette annuelle, sarriete commune, herbe de St. Julien, sadree, savouree;* in Germany, *bohnenkraut, pfefferkraut, kollkraut;* in Flanders and Holland, *boonenkruid;* in Denmark, *sar;* in Italy, *santoreggia;* in Spain, *ajedrea comun, sojulida;* in Portugal, *segurelha;*[87] in Norway, *sar;*[88] in the Mauritius, *sarriette.*[89]

[80] McIntosh. Book of the Gard., II., 238.
[81] Palladius. Lib., III., c. 24.
[82] Albertus Magnus. De Veg., Jessen Ed., 569.
[83] Turner. Libellus, 1538.
[84] Bryant. Fl. Diet., 1783, 143.
[85] McMahon. Am. Gard. Kal., 1806.
[86] Gray. Syn. Flora., II., Pt. I., 358.
[87] Vilmorin. Les Pl. Pot., 544.
[88] Schubeler. Culturpfl., 89.
[89] Bojer. Hort. Maur., 248.

Satureja montana L.

A species known to the earlier botanists, and probably known to the ancient culture, although I do not find it identified with any certainty. It is mentioned in Turner's Herbal in 1562, and this is as far back as we have printed registers; but there can be little doubt but that this, with the summer savory, was much cultivated in far earlier times in England.[90] It was in American gardens in 1806.[85] The uses are the same with the preceding species.

Winter Savory is called in France, *sarriette vivace, sarriette des montagnes;* in Germany, *winter bohnen-oder pfefferkraut;* in Spain, *hisopielo.*[87]

Satureja capitata L.

This species is omitted from our most modern books on gardening, although recorded in American gardens as late as 1863.[91] It is mentioned as under culture in many of the early works on botany and gardening.

Headed Savory is called in France, *thim de Crete.*[92]

Satureja viminea L.

A native of Jamaica, and introduced in Britain in 1783, and has two varieties. It was recorded by Burr,[91] in 1863, as in American gardens, but as little used. It is said to be much used for seasoning in its native country. It is not now recorded as in European cultivation.

Satureja juliana L.

This Savory is mentioned by Gerade,[93] in 1597, as sown in gardens. It is a native of the Mediterranean countries, called in Greece, *ussopo,* in Egyptian, *pesalen.*[94] Its name has disappeared from our seed catalogues.

90 Miller's Dict., 1807.
91 Burr. Field and Gard. Veg., 1863.
92 Tournefort. Inst., 1719, 196.
93 Gerarde. Herbal, 1507, 461.
94 Pickering. Ch. Hist., 343.

SAVOY CABBAGE. *Brassica oleracea bullatta* DC.

This race of cabbage is distinguished by the blistered surface of their leaves, and by forming only a loose or little compact head. I am inclined to believe that the heading cabbages of the ancient Romans belonged to this class, as in their descriptions there are no indications of a firm head, and at a later period this form is named as if distinctly Roman. Thus Ruellius[95] in 1536 describes under the name *Romanos* a loose heading sort of cabbage, but does not describe it particularly as a Savoy. This sort probably is the *Brassica italica tenerrima glomerosa flore albo* figured by J. Bauhin[96] in 1651, its origin, judging from the name, being ascribed to Italy, and also figured by Chabraeus,[97] 1677, under the same name, and with the additional names of *Chou d'Italie* and *Chou de Savoye.* In the Adversaria[98] and elsewhere this kind is described as tender, and as not extending to the northern climates. I do not know of this form, so carefully pictured, as existing under culture, and it has doubtless been superseded by better varieties.

In the Savoy class three types are to be seen. The most common is the spherical-headed, next the long-headed or elliptical, and lastly the conical. There are a number of varieties. In 1883 Vilmorin describes fifteen in his Les Plantes Potageres, and names others. In the report of the New York Agricultural Experiment Station for 1886, thirteen varieties are described.

The SPHERICAL-HEADED. This race is the most common, and occurs in various degrees of blistering, and in a large number of varieties. The following synonymy embraces this type:

Brassica crispa. Matth., 1558, 247; Pin., 1561, 162; Cam. epit., 1586, 249; Pancov., 1673, n. 614.

B. alba crispa. Lugd., 1587, I., 520.

B. patula crispa. Sabauda æstiva. Lob. ic., 1501, I., 244; Chabr., 1677, 269.

B. sabauda. Ger., 1537, 247.

B. sabauda crispa. Ger., l. c.

95 Ruellius. De Natura Stirpium, 1536, 477.
96 J. Bauhin. Hist., 1651, II., 827.
97 Chabraeus. Icones et Sciag., 1677, 269.
98 Pena and Lobel. Adv., 1570, 91.

B. sabauda rugosa. J. Bauh., 1651, II., 828.

The Illiptical-Headed. This race has also a syonomy, and has been long known.

Brassica sabauda hiberna. Lob. ic., 1591, I., 244.

B. alba capite oblongo non penitus clauso. C. Bauhin, Phytopin., 1596, 176; Pin., 1623, III.

B. sabauda. Dod. Pempt., 1616, 624.[99]

The Conical-Headed. Of this type I know of but one form, the *Conical Savoy*, the French synonyms *chou milan a tete longue, chou frise pointu*, and *chou milan pain de sucre.* This variety finds mention in French works on gardening in 1824, 1826, and 1829.[100]

The modern names of the Savoy Cabbage are: In France, *choux de milan, chou milan, chou cabus frise, chou cloque, chou de Hollande, chou pancalier, chou de savoie;* in Germany, *wirsing, savoyerkohl, borskohl;* in Flanders and Holland, *savooikool;* in Denmark, *savoykal;* in Italy, *cavolo di milano, verza;* in Spain, *col de milan, col risada, col lombarda;* in Portugal, *saboia;*[101] in India, *sikoree kobee.*[102]

In ancient times it was called: In English, *savoie cole*, Ger., 1597, *savoy cabbage*, Ray, 1686; in France, *chou de savoye*, Lyte, 1586, *choux vers*, Pin., 1561; in Germany, *koel*, Pin., 1561, *krauskol*, Cam. Epit., 1586; in Dutch, *savoy koolen*, Lyte, 1586; in Italy, *cavoli, verza*, Pin., 1561, *cavolo crespo, verza crespa*, Cam. Epit., 1586; in Spain, *colles* or *covves*, Pin., 1561.

A more minute examination would serve to identify nearly all of our sub-varieties with kinds named preceding 1830.

SCARLET RUNNER BEAN. *Phaseolus multiflorus* Willd.

This bean, a native of South America, was described and figured by Cornutus[103] in 1635, under the name *Faseolus puniceo flore;* but it appears in Johnson's edition of Gerarde, 1633. It was first cultivated as an ornamental plant, and the first mention

[99] The figure not clear, but the description is.

[100] LH'ort. Fran., 1824; Petit. Dict. du Jard.. 1826; Noisette, Man., 1829.

[101] Vilmorin. Les Pl. Pot., 1883, 121.

[102] Speede. Ind. Handb. of Gard., 1842, 113.

[103] Cornutus. Canad. Plant., 1635, 184, Fig. 185.

I find of its use as a vegetable is by Townsend[104] in 1726, who says "the cods are eaten sometimes like other kidney beans," and Stevenson,[105] in 1765, gives directions for kitchen-garden culture. In America, in 1806,[106] it was cultivated exclusively for ornament, and first appears in the vegetable garden about 1819.[107] At the present time five varieties are given by Vilmorin, but one of these, the black, I have neither seen nor found recorded for American gardens, and the hybrid is not clearly described.

The synonymy of the different varieties is as below:

I. *Phaseolus flore coccineo.* Ray, 1686, I., 884.

P. multiflorus coccineus. Lam. ex Martens, n. 123.

Large Scarlet Climber. Mawe, 1778.

Haricot d'Espagne rouge. Vilm., 1883, 276.

Scarlet Runner. N. Y. Agr. Exp. Sta. Rept., 1883, n. 56; 1874, n. 89.

II. *Faseolus puniceo flore.* Cornutus, 1635, 184.

Phaseolus indicus flore miniato, semine nigro. Titius, 1654, ex Mart.

P. multiflorus niger. Martens, 1869, n. 121.

Haricot d'Espagne a grain completement noir. Vilm., 1883, 277.

III. *Phaseolus multiflorus bicolor.* Anabida, 1827, ex Martens, 83.

Haricot d'Espagne bicolor. Vilm., 1883, 227.

Painted Lady. N. Y. Agr. Exp. Sta. Rept., 1884, n. 90.

IV. *Phaseolus indicus flore et semine albo.* Titius, 1654, ex Martens.

Phaseolus multiflorus albus. Martens, 1869, 82.

Large White Climber. Mawe, 1778.

White Dutch Runners. Gardiner and Hepburn, 1818, 68.

White or Dutch Runner. N. Y. Agr. Exp. Sta. Rept, 1884, n. 91.

This synonymy establishes the dates at which each variety appeared, and the varieties have kept true since then. The seed of

[104] Townsend. Seedsman, 1726, 83.
[105] Stevenson. Gard. Kal., 1765, 103.
[106] McMahon. Am. Gard. Kal., 1806.
[107] Practical Am. Gard., Baltimore, 1819, 84.

each produces its own variety, unless the blooms have been cross-fertilized. Under these circumstances I have noted the Scarlet Runner seed producing the White Runner; the White Runner seed producing the Scarlet Runner, the Painted Lady, and another form which I think is the Haricot d'Espagne hybrid of Vilmorin. There have appeared in these crossed plants no intermediate types whatsoever, and I believe that the mixed seed tends to revert ultimately to the original variety, having purged itself of its contamination.

The names under which the species is known are: In France, *haricot d'Espagne;* in Germany, *arabische bohne;* in Holland, *tursche boon;* in Italy, *fagivolo di Spagna;*[108] in India, *lal loba* or *lal lobeea.*[109]

SCOLYMUS. *Scolymus hispanicus* L.

This plant is supposed by authors to be the *skolumus* and *leimonia* of Theophrastus, 322 B.C., and its root recorded as edible; the *scolymus* of Pliny A.D. 79, recorded as a food plant. The wild plant was seen in Portugal and Spain by Clusius[110] in 1576. The plant was described by Gerarde[111] in England in 1597, but he does not appear to have grown it. It was in the botanic gardens at Oxford[112] in 1658, but receives no other than a quoted mention from Clusius by Ray[113] in 1686. It appears not to have been in English culture in 1778,[114] nor in 1807,[112] and in 1869 is recorded as a new vegetable.[115] In 1597 Gerarde[111] mentions its culture in Holland, and in 1616 Dodonaeus[116] says it was planted in Belgian gardens. In France, in 1882, it is said not to be under culture, but that its long fleshy root is used as a kitchen vegetable in Provence and Languedoc.[117] In 1883 it is included among kitchen esculents by Vilmorin.[118] It is accorded

108 Vilmorin. Les Pl. Pot., 276.
109 Speede. Ind. Handb. of Gard., 125.
110 Clusius. Hisp., 1576, 448; Hist., 1601, 2, 153.
111 Gerarde. Herb., 1597, 993.
112 Miller's Dict., 1807.
113 Ray. Hist., 1686, 257.
114 Mawe. Gard., 1778.
115 Gard. Chron., 1869, 584.
116 Dodonaeus. Pempt., 1616, 726.
117 Bon Jard. 1882, 566.
118 Vilmorin. Les Pl. Pot., 1883, 547.

by Burr[119] for American gardens in 1863, and its seed was offered in American seed catalogues of 1882, perhaps a few years earlier.

Scolymus, Spanish scolymus, Spanish oyster plant,[119] or *golden thistle*[120] is called in France, *scolyme d'Espagne cardouille, cardousse, epine jaune;* in Holland, *varkens distel;* in Italy, *barba gentile, cardo scolimo;* in Spain, *escolimo, cardilla;*[118] at Constantinople, by the Greeks, *kephalaggalho.*[121]

SCORZONERA. *Scorzonera hispanica* L.

This plant was not mentioned by Matthiolus[122] in 1558, but in 1570 was described as a new plant, called by the Spaniards scurzonera or scorzonera. In 1576, Lobel[123] says the plant was in French, Belgian and English gardens from Spanish seed. Neither Camerarius[124] in 1586, nor Dalechampius[125] in 1587, nor Bauhin[126] in 1596, nor Clusius[127] in 1601, indicate it as a cultivated plant, and Gerarde,[128] in 1597, calls it a stranger in England, but growing in his garden. In 1612 Le Jardinier Solitaire[129] calls it the best root which can be grown in gardens. The use of the root as a garden vegetable is recorded in England by Meager[130] in 1683, Worlidge[131] in 1683, by Ray[132] in 1686, etc. Quintyne[133] in France, in 1690, calls it "one of our chiefest roots." Its cultivation does not, therefore, extend back to the sixteenth century. No varieties are recorded under culture. It was in American gardens in 1806.

The *black oyster plant, black salsify, Spanish salsify, or scorzonera,* is called in France, *scorsonere, scorzonere d'Espagne, corcionnaire, ecorce noire, salsifis noir;* in Germany, *scorsoner, schwarz-*

[119] Burr. Field and Gard. Veg., 1863, 94.
[120] Vilmorin. The Veg. Gard., 1885, 249.
[121] Forskal. Fl. Aeg., XXX.
[122] Matth. Com., 1558; 1570, 370; 1598, 409.
[123] Lobel. Obs., 1576, 298.
[124] Camerarius. Epit., 1586, 314.
[125] Hist. Gen. Lugd., 1587, 1206.
[126] Bauhin. Phytopin., 1596, 537.
[127] Clusius. Hist., 1601, II., 137.
[128] Gerarde. Herb., 1596, 597.
[129] Le Jard. Solit., 1612, 210.
[130] The Eng. Gard. 1683, 61.
[131] Syst. Hort., by J. W. Gent, 1683, 186.
[132] Ray. Hist., 1686, 248.
[133] Quintyne. Comp. Gard., 1693, 200.

wurzel; in Flanders and Holland, *schorseneel;* in Denmark, *schorsenerrod;* in Italy, *scorzonera;* in Spain, *escorzonera, salsifi nero;* in Portugal, *escorcioneira;*[134] in Norway, *skorsoneerrod.*[135]

SCURVY GRASS. *Cochlearia officinalis* L.

The wild plant, as an antiscorbutic salad, has long been in request, and received especial commendation in Holland, where, on account of its abundance, it does not seem to have been cultivated. In 1586 it is mentioned as common in gardens by Camerarius;[136] in 1597 it was grown in England by Gerarde[137] and a few others; in 1598 it was only found in gardens in Germany;[138] in 1616 recorded in the gardens of Brabant by Dodonaeus.[139] In 1686 called the Garden Scurvy by Ray.[140] In the United States it is recorded among garden vegetables by Burr[141] in 1863.

Scurvy Grass is called in France, *cochlearia officinal, herbe au scorbut, herbe aux cuillers;* in Germany, *loffelkraut;* in Flanders, *lepelkruyd;* in Holland, *lepelblad;* in Denmark, *kokleare;* in Italy and Spain, *coclearia;* in Portugal, *cochlearia;*[142] in Norway, *cochleare.*[143]

SEA KALE. *Crambe maritima* L.

Although this plant is recorded as wild on the coast of Britain, and as fit for food, by Pena and Lobel,[144] Dalechampius,[145] Gerarde,[146] and Ray,[147] yet it was brought into English culture from Italy[148] a few years preceding 1765, and the seed sold at a

134 Vilmorin. Les Pl. Pot., 548.
135 Schubeler. Culturpflanz., 85.
136 Camerarius. Epit., 1586, 271.
137 Gerarde. Herb., 1597, 324.
138 Matth. Op., 1598, 381.
139 Dodonaeus. Pempt., 1616, 593.
140 Ray. Hist., 1686, 432.
141 Burr. Field and Gard. Veg., 1863, 397.
142 Vilmorin. Les Pl. Pot., 158.
143 Schubeler. Culturpfl., 102.
144 Pena and Lobel. Adv., 1570, 92.
145 Hist. Gen. Lugd., 1587, 526.
146 Gerarde. Herbal, 248.
147 Ray. Hist., 1686, 838.
148 Stevenson. Gard. Kal., 1765, 22.

high price as a rarity. In 1778[149] it is said to "be now cultivated in many gardens as a choice esculent," and in 1795[150] it was advertised in the London market. According to Heuze[151] it was first cultivated in France by Quintyne, the gardener to Louis XIV., but I do not find it mentioned in my edition of Quintyne of 1693; it, however, is mentioned in the French works on gardening of 1824[152] and onward. The Sea Kale is named in American gardens in 1806,[153] and by seedsmen in 1829 and onwards, and in 1809 is recorded as cultivated near Boston, and introduced to the public in 1813.[154] At the Mauritius it was cultivated in 1837.[155] It is even now but rarely grown in the United States. There are no varieties.

Sea Kale or *beach-cole* is called in France, *crambe*, *chou marin*; in Germany, *meer-kohl*, *see-kohl*; in Flanders and Holland, *zeekool*, *meerkool*; in Denmark, *strandkaal*; in Spain, *soldanela maritima*, *crambe*, *col marino*;[156] in Italy, *crambe marina*.[157]

SHALLOT. *Allium ascalonicum* L.

The *askalonion krommoon* of Theophrastus, and the *cepa ascalonia* of Pliny, are usually supposed to be our Shallot, but this identity can scarcely be claimed as assurred. It is not established that it occurs in a wild state, and Decandolle is inclined to believe it a form of *A. cepa* or onion.[158] It is mentioned and figured in nearly all the early botanies, and many repeat the statement of Pliny that it came from Ascalon, a town in Syria, whence the name. Indeed, Michaud, in his History of the Crusades, says that our gardens owe to the holy wars Shallots, which take their name from Ascalon.[159] Amatus Lusitanus,[160] in 1554, gives

149 Mawe. Gard., 1778.
150 *Times*, Apr., 30, 1795, quoted from Gard. Chron., May 15, 1886, 626.
151 Heuze. Les Pl. Alim., II., 667.
152 L'Hort. Franc., 1824; Noisette, Man., 1859, etc.
153 McMahon. Am. Gard. Kal., 1806.
154 Mass. Agr. Reposit., 1814, 247.
155 Bojer. Hort. Maurit., 1837, 16.
156 Vilmorin. Les Pl. Pot., 1883, 192.
157 McIntosh. Book of the Gard., II., 116.
158 Decandolle. Orig. Des Pl. Cult., 56.
159 Michaud. Hist. of the Crusades, 1853, III., 329.
160 Amatus Lusitanus, in Diosc., 1554, 287.

Spanish, Italian, French, and German names, which goes to show its culture in these countries. In England, they are said to be cultivated in 1633,[161] but McIntosh[162] says they were introduced in 1548, but they do not seem to have been known to Gerarde in 1597. In 1633, Worlidge[163] says "eschalots are now from France become an English condiment." They are enumerated for American gardens in 1806.[164] Vilmorin[165] mentions one variety with seven sub-varieties little differing.

The *Shallot* or *eschalot* is called in France, *eschalote*, *chalote*, *ail sterile;* in Germany, *schalotte*, *eschlauch;* in Flanders and Holland, *sjalot;* in Denmark, *skalottelog;* in Italy, *scalogno;* in Spain, *chalote*, *escaluna;* in Portugal, *eschalota;*[165] in Norway, *skalotlog;*[166] in the Mauritius, *echallotte;*[167] in China, *kiai;*[168] in Cochinchina, *cay nen;*[169] in India, *gundhuna*, *gudheenk*.[170]

AN AMERICAN TERRESTRIAL LEECH.

BY S. A. FORBES.

ALTHOUGH leeches are normally aquatic worms, terrestrial species of various genera occur in many parts of the world—Ceylon, Java, Summatra, Australia, Japan, Chili, and Brazil—and some properly aquatic leeches (*Trocheta subviridis* of Europe, for example) leave the water in pursuit of earthworms and other prey. I cannot find, however, that either the terrestrial habitat or the earthworm habit has been reported for any North American leech —a fact which gives especial interest to a hitherto unnoticed species occurring commonly in Illinois, and found, so far as known, only in moist earth.

161 Miller's Dict., 1807.
162 McIntosh. Book of the Gard.
163 Syst. Hort., by J. W. Gent, 1683, 193.
164 McMahon. Am. Gard. Kal., 1806, 190.
165 Vilmorin. Les Pl. Pot., 200.
166 Schubeler. Culturpf., 53.
167 Bojer. Hort. Maurit., 347.
168 Smith. Mat. Med. of China, 7.
169 Loureiro. Cochinch., 202.
170 Speede. Ind. Handb. of Gard., 159.

This terrestrial leech was first obtained by me in April, 1876, at Normal, McLean county, Illinois, where it was dug up in a house garden about a dozen rods from the nearest rivulet. An example sent the following year to Prof. A. E. Verrill, with some remarks on its superficial characters, was by him identified, provisionally and with some hesitation, as his *Semiscolex grandis*, originally described[1] from three aquatic individuals obtained from Lake Huron and Lake Superior and a river in Connecticut. I have now, however, fifty-six specimens of this leech, all from the earth in central Illinois, sometimes half a mile or more from water, and representing collections made at different times from April, 1876, to June, 1890; while, on the other hand, it has not once occurred in the course of a large amount of aquatic work done in the same regions during these fifteen years. It has, moreover, constant characters which clearly distinguish it from *Semiscolex grandis*, as far as one may judge by a comparison with Verrill's description, and I do not doubt that it is undescribed. Its only known food is earthworms of various genera, and these it swallows entire—as I have repeatedly found by dissection, and demonstrated likewise by feeding experiments on leeches in captivity. Indeed, my serial sections have this peculiarity: that they present the structure of three worms in one section—that of the leech itself and of two earthworms in its stomach.

From the fact that all my specimens were obtained during the early months of the year—from March to June—it is probable that this leech, like the earthworm, penetrates to considerable depths during the midsummer drouths.

DIAGNOSIS: *Semiscolex terrestris*, n. sp. This is one of the largest of our leeches, my contracted alcoholic specimens reaching a length of seven inches, a width of three-fourths, and a depth of three-eighths of an inch. In form, it is heaviest posteriorly, be-

[1] Synopsis of the North American Fresh-Water Leeches. By A. E. Verrill. U. S. Commission of Fish and Fisheries. Part II. Report of the Commissioner for 1872 and 1873, p. 672 (Published in 1874.) This species clearly belongs to Kinberg's genus Semiscolex, but on the other hand there seems little, except the very rudimentary condition of the pharyngeal jaws, to exclude it from Aulastoma, Moqu. (See Diesing, Systema Helminthum, Vol. I., p. 461; and Apathy, Süsswasser-Hirudineen, in Zoologische Jahrbücher, Band III., p. 793), but in the absence of material for a comparison of these genera, I have followed Verrill in using Kinberg's name.

ing widest at about the eighth annulus in front of the acetabulum, but tapering very gradually, or scarcely at all, thence forward to the antierior fourth, and thence more rapidly to the mouth. Its transverse section is depressed oval, flattened beneath the margins of the body obtuse.

The color is sooty drab, varying to plumbeous black, somewhat lighter beneath, uniform in tint, and quite without spots or mottlings of any sort. A darker median longitudinal stripe, very conspicuous and well defined, is almost invariably present; a paler marginal stripe, often approaching buff, little less constantly so, and a ventral submarginal stripe of the same color as the dorsal one, likewise quite frequent. The surface is everywhere smooth, and I find no external trace of segmental papillæ.

There are ninety-nine complete annuli from the mouth to the posterior sucker, four imperfect annuli in the cephalic lobe, and one such just before the vent—104 in all. All the perfect annuli are very distinct, except the first two, which, while well distinguished dorsally, are almost completely fused beneath to form the posterior border of the mouth. In front of the first annulus is the upper lip, divided by a delicate median groove. There are, consequently, eleven such grooves meeting the margin of the mouth, its posterior boundary being formed by the undivided ventral portion of the fifth annulus. The eyes are ten in number, placed upon the first, second, third, fifth, and eighth annuli, representing somites one to five. The acetabulum is broad oval, wider than long, and measures about ten mm. in its greatest diameter. The vent is large and surrounded by irregular radiating grooves.

The first nephridial pore is at the anterior margin of the tenth complete annulus—the fourteenth in all—and the last or seventeenth pore at the anterior margin of the ninetieth ventral annulus—the ninety-fourth of the full series. These pores open on the ventral surface just within the dark ventral line, and consequently at some little distance from the margin of the body. The male sexual opening is on the posterior part of the twenty-eighth entire annulus, and the female opening on the thirty third.

Within the buccal cavity is a prominent circular fold. Maxillæ three, rudimentary, distinguishable only in sections, with an ill-

defined armature of teeth. The pharynx presents ten to fifteen longitudinal folds, the number varying in different parts—the average twelve or thirteen.

I have seen no specimens of *Semiscolex grandis* Verrill, but draw from the author's description distinctions in the number of annulations ("about ninety" in *grandis*), the markings of the upper lip, the positions of the sexual orifices (in *grandis* in the twenty-fifth and thirtieth annuli respectively), and in the color markings—*grandis* being without stripes, and spotted or blotched with dark, in Verrill's specimens.

RECENT BOOKS AND PAMPHLETS.

AGASSIZ, A., and C. O. WHITMAN.—The Development of Osseous Fishes. History of the Egg from Fertilization to Cleavage. Memoirs Harvard Mus. Comp. Zool., Vol. XIV., 1889. From A. Agassiz.

ALBRECHT, DR.—Uber den Stammbaum der Raubthiere. Sitzungsbericht der Physicalisch-ökonomischen Gesellschaft zu Konigsberg, 1879.

ALLEN, W. F., and D. E. SPENCER.—Higher Education in Wisconsin. Bur. of Ed., Cir. of Inf. No. 1, 1889.

Annual Report Geol. and Nat. Hist. Sur., Canada, Vol. III., 1887–'88, with maps.

Annual Report Ohio Agri. Eper. Station, 1888.

Annarulŭ Biurouliu Geologicŭ, Anul V., No. 1.

Annarulŭ Biurouliu Geologicŭ, Anul II., 1885.

BARUS, C.—On the Thermo-Electric Measurement of High Temperatures. Bull. U. S. Geol. Sur., No. 54, 1889. From the Dept. Int.

BECKER, G. F.—Geology of the Quicksilver Deposits of the Pacific Slope. Monograph U. S. Geol. Sur., Vol. XIII.

BOULENGER, G. A.—Descriptions of a New Snake and Two New Fishes obtained by Dr. H. von Ihering in Brazil.—Descriptions of New Typhlopidæ in the British Museum.—Descriptions of New Reptiles and Batrachians from Madagascar. Extracts *Ann. and Mag. Nat. Hist.*, 1889.—Description of a New Batrachian of the Genus Leptobrachium, obtained by M. S. Fea in the Karens Mts., Burma. Ext. Ann. Mus. Civ. di Sto. Nat., Genoa, 1889. From the author.

BURMEISTER, H.—Die Fossilen Pferde der Pampasformation, 1889. Fromthe author.

Célébration du Centenaire de M. Chevreul. From Charles Brongniart.

Circular No. 6, Am. Soc. Psychical Research.

Circular No. 6, No. 8, No. 10, University of Texas.

CLARKE, F. W.—Report of Work Done in the Division of Chemistry and Physics, 1886–'87. Bull. U. S. Geol. Sur., No. 55. From the Dept. Int.

D'AGINCOURT, DR.—Methodes de Cartographic Geologique Employées par U. S. Geol. Sur. Annuire Geologique Universal, Appendice.

DIXON, S. G.—Education in America. Extract *Med. and Surg. Rept.*, 1890.

EIGENMANN, C. H.—Notes on the Specific Names of Certain North American Fishes. Extract Proc. Phila. Acad. Nat. Sci., 1887. From the author.

EIGENMANN, C. H.—On the Genesis of the Color-cells of Fishes. Extract *West Am. Sci.*, 1889.

EIGENMANN, R. S.—Description of a New Species of Euprotomicrus. Extract Proc. Cal. Acad. Sci., Vol. III. From the author.

EVERMANN, B. W.—Birds of Carroll County, Indiana.[1] Extract *Auk*, Vol. VI., 1889.

EVERMANN, B., and C. H. BOLLMAN.—Notes on a Collection of Fishes from the Monongahela River. From the author.

EVERMANN, B., and O. P. JENKINS.—Notes on Indiana Fishes. Extract Proc. U. S. Nat. Mus., 1888.

FONTAINE, W. M.—The Potomac or Younger Mesozoic Flora. Monograph U. S. Geol. Sur., Vol. XV., Parts I. and II.

FORSYTH, C. J.—L'Ossario di Olivola in Val di Magra. Extract Dal Processo Della Soc. Toscana di Sci. Nat., 1890.

GADOW, H.—Dr. Bronn's Klassen und Ordnungen des Thier-Reichs. Sechster Band, IV. Abtheilung, Vögel, Aves.

GALLOWAY, B. T.—Treatment of the Black Rot of the Grape. Circ. No. 6, U. S. Dept. Agri.

GILBERT, C. H.—Notes on the Occurrence of *Gillichthys y-cauda*, at San Diego, Cal. Extract Proc. U. S. Nat. Mus., Vol. XII., 1890.

GOETTE, A.—Entwickelungeschicte des Flussneunauges (*Petromyzon fluviatilis*) Fünftes heft.

GREGORIO, A. DE.—Iconografia Conchiologica Mediterranea Vivente et Terziaria. *Ann. de Geol. et de Palæontol.*, 1889. From the author.

HAY, R.—A Geological Reconnaissance in Southwestern Kansas. Bull. U. S. Geol. Sur., No. 57.

HITCHCOCK, C. H.—Wright's "Ice Age in North America, and its Bearings on the Antiquity of Man." From the author.

JORDAN, D. S.—Descriptions of Fourteen Species of Fresh-Water Fishes Collected by the U. S. Fish Com. in 1888.—Description of a New Species of Callionymus from the Gulf of Mexico. Extracts Proc. U. S. Nat. Mus., 1888.

JORDAN, D. S.—Report of Explorations Made During 1888 in the Alleghany Region of Virginia, North Carolina, Tennessee, and Western Indiana, with an Account of the Fishes found in Each of the River Basins of Those Regions. Extract Bull. U. S. Fish Com., Vol. VIII., 1888.

JORDAN, D. S., and C. H. BOLLMAN.—Descriptions of New Species of Fishes Collected at the Galapagos Islands and along the Coast of the United States of Colombia, 1887–'88. Proc. U. S. Nat. Mus., Vol. XII., pp. 149-183. From the Smithsonian Institution.

JORDAN, D. S., and B. W. EVERMANN—Description of the Yellow-finned Trout of Twin Lakes. Extract Proc. U. S. Nat. Mus., Vol. XII., 1889. From the author.

JORDAN, D. S., and B. W. EVERMANN.—Food Fishes of Indiana. Extract Rep. Com. Fish and Fisheries 1882–83.

JORDAN, D. S., and B. W. EVERMANN.—Description of the Yellow-finned Trout of Twin Lakes, Col. Extract Proc. U. S. Nat. Mus., Vol. XII., 1890.

JORDAN, D. S., and C. H. EIGENMANN.—Notes on a Collection of Fishes sent by C. C. Leslie from Charleston, South Carolina. Extract Proc. U. S. Nat. Mus., 1887.

JORDAN, D. S., and C. H. GILBERT.—Description of a New Species of Thalassophryne from Punta Arenas and Panama. Ext. Proc. U. S. Nat. Mus., Vol. X.

KEYES, C. R.—Lower Carbonic Gastropoda from Burlington, Ia.—The American Species of Polyphemopsis. Sphærodoma: A Genus of Fossil Gastropods. Extracts Proc. Acad. Nat. Sci., Phila., 1889.—Variation Exhibited by a Carbonic Gastropod.—The Subgeneric Groups of Naticopsis. Extract *Am. Geol.*, 1889.—The Carboniferous Echinodermata of the Mississippi Basin. Extract *Am. Jour. Sci.*, Vol. XXXVIII., 1889. From the author.

KNOWLTON, F. H.—Fossil Wood and Lignite of the Potomac Formation. Bull. U. S. Geol. Sur., No. 56.

KUNZ, G. F.—Precious Stones. Extract Appleton's Phys. Geog.

LAWRENCE, G. N.—An Account of the Breeding Habits of *Puffinus auduboni* in the Island of Grenada, West Indies, with a Note on *Zenaida rubripes*. Extract *Auk*, Vol. VI., 1889.

LERCH, O.—Uber Brom und Jodmagnesium. Inaugural Dissertation der Hohen Philosophischen Facultät der Universität Rostock. From the author.

LERCH, O., and W. F. CUMMINS.—A Geological Survey of the Concho Country. Extract *Am. Geol.*, 1890. From the author.

List American Committee Balfour Memorial.

Liste Générale des Membres Congres Geol. International, 1888.

LYMAN, B. S.—A Geol. and Top. Map of the New Boston and Morea Coal Lands in Schuylkill County, Pa.

MEEK, S. E., and R. NEWLAND.—A Review of the Species of the Genus Esox. Extract Proc. Phila. Acad. Nat. Sci., 1885.

MEYER, O.—Upper Tertiary Invertebrates from West Side of Chesapeake Bay. Extract Proc. Acad. Nat. Sci., Phila., 1888. From the author.

MILLER, S. A., and F. E. Gurley.—Description New Genera and Species of Echinodermata, from the Coal-Measures and Sub-Carboniferous Beds of Indiana, Missouri, and Iowa. From the authors.

NEHRING, HERR.—Uber den Schädel eines Franqueiro Ochsen aus Brasilien. Sitzungs-Bericht der Gesellschaft naturforschender Freunde zu Berlin, 1888.

Photographs of Bones of *Castoroides ohioensis*, found near Richmond, Indiana. From Prof. Joseph Moore.

PAVLOW, M.—Hipparion de la Russie.—Chevaux Pléistocènes de la Russie et leurs rapports aves les Chevaux des autres pays. Extract Bull. de la Soc. Imper. des Naturalistes de Moscou, 1889. From the author.

Proceedings Am. Ass. Adv. Sci., 1888.

Proceedings London Geo. Soc., 1888–'89.

Programm der Gesellschaft für Experimental Psychologie zu Berlin, 1888.

Proc. Twelfth Convention Empire State Ass. for Deaf Mutes, at Rochester, 1888. From F. L. Seliney.

REINHARDT, J., O. WINGE, H. WINGE.—Memoirs on Animal and Human Bones found in Brazilian Limestone Caves, now in the Paleon. Dept. Copenhagen University. Vol. I. Published by C. F. Lütken, 1888.

Report of the Board of Regents of the Smithsonian Institution for the Year Ending June 30, 1886.

Report of the Committee appointed January 6, 1888, by the Am. Philosoph. Soc., to assist the Commission on Amended Orthography.

RICE, W. N.—Science Teaching in the Schools. From the author.

RINGUEBERG, E. N. S.—The Calceocrinidæ. Extract Ann. N. Y. Acad. Sci., Vol. IV., 1889.

SCRIBNER, F. L.—Report on the Experiments made in 1888 in the Treatment of the Downy Mildew and Black Rot of the Grape-Vine. Bull. No. 10, Dept. Agri.

STEARNS, R. E. C.—On Certain Parasites, Commensals, and Domiciliares in the Pearl Oysters Meleagrinæ. Extract Ann. Report Smithsonian Institution, 1886. From the author.

SWINHOE, C., and COATES, E. C.—A Catalogue of the Moths of India. From trustees of the Indian Museum.

TURNER, W.—On the Placentation of Halicore dugong. Trans. Roy. Soc. Edinburgh, Vol. XXXV. From the author.

Vocabulario Tzotzil Español dialecto de los Indies de la parte Orienta del Estado de Chiapas.

WEBER, R.—Uber Patinabildung. Sonder-abdruck aus Dingler's Polytechnischem Journ., 188a. From O. Lerch.

WRIGHT, G. F.—The Nampa Image. Extract Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889.—A Moraine of Retrocession in Ontario. Ext. Bull. Geol. Soc. Am., Vol. I. From the author.

General Notes.

GEOGRAPHY AND TRAVEL.

Asia.—The Great Central Trade Route.—Mr. Mark S. Bell (Proc. Roy. Geog., Feb., 1890) contributes a lengthened and interesting account of his journey along the Great Central Trade Route, which leads from Peking to the remote province of Kashgaria. Two routes connect the east of China with Kashgaria, viz: The Alashan route, along which Mr. Younghusband was the first Englishman to travel, and the above-mentioned Great Central Trade Route, traversed by Mr. Bell in 1887. The latter route was gone over in 1874–'75 by Colonel Losnoffsky, who reported that it represented all conditions for becoming the most important artery between Russia and China. It is by no means the straightest route possible, since it first trends considerably to the south to the Wei valley, and then proceeds northwestward to the line of Chinese towns of the province of Kansu. From Peking to Paw-Ting-Fu (218 miles) the road passes over an alluvial plain; thence to Khavailu (157 miles) it lies upon the hills between Chili and Shansi; rises to a height of 4500 feet, and then descends to Tai-Yuen-Fu, the capital of Shansi. The road is entirely on metal, and from Khavailu to Si-Ngan-Fu, the capital of Shensi, consists of nothing more than ruts at the bottom of a gully in the pliable loess of the district. Tai-Yuen-Fu has a population of 5,000, and its nearest port is Tientsin. From Tai-Yuen-Fu to Ping-Yong-Fu (185 miles) the road passes down the valley of Fuen-Ho. Ping-Yong-Fu has a population of about 20,000; between it and Si-Ngan-Fu, the capital of Shensi, intervene 253 miles, still over the loess. The last-named city was the capital of China for more than 2,000 years, from 1122 B.C. to 1127 A.D. The Yellow River is crossed at Tung-Kwan, 93 miles before reaching Si-Ngan-Fu. Tung-Kwan is a very important place, since it is situated on the main line of traffic between the east and west of China at the point where that line is crossed by the chief route from the southeast to the northwest of the kingdom. No commercial route of importance crosses the Hoang-Ho north of Tung-Kwan. With such roads as have been described, and no railways, it may well be conceived that land-carriage in China is very costly—in practice, 30 miles upon land is in expense equal to 600 to 800 miles of water-carriage. The province of

Shensi is in great part a vast wheat field, and is exceedingly rich in coal, iron, and rock-salt. From Singan-Fu to Lan-Chau-Fu, the capital of Kan-Fu, the road traverses a hilly country, usually 6,000 or 7,000 feet above the sea, and sometimes rising to 8,000 or 10,000, for a distance of 449 miles. Kan-Fu is, as it were, a wedge of China driven to the northwest between Mongolia and Kashgaria, from which it is, however, separated by a portion of the desert of Gobi. Formerly it joined the best portion of Tangut, which was destroyed by Genghis or Chenghz-Khan. From that period until now it has formed an integral portion of the Chinese Empire, and its importance has been recognized by all Chinese dignasties. The great wall was carried northwards to Kia-Yu-Kwan, 500 miles to the north of the capital, Lan-Chau-Fu, with a view to its protection. Previous to the Mohammedan rebellion, during which Kashgaria was for awhile independent under the rule of Yakub Beg, the population of Kansu was about 1,500,000, but during the wars which ensued before that rebellion was finally squelched the inhabitants were reduced to some 200,000, and all settlements except a few of the largest walled towns were deserted. The Mohammedans inspired the greatest fear in the Chinese settlers, who fled before them almost without resistance. It is a common mistake to suppose that the rebellion was finally put down by the bravery of the Chinese troops, whereas the most potent weapons were really bribery, the starvations of the garrisons of the town, and the distributions of buttons of rank to traitorous leaders. The recovery of Kansu is at present but very partial. Only the richest oases are in cultivation. The population is exceedingly degraded, opium-smoking is almost universal, young girls are regularly sold. Sodomy is common, and during the rebellion cannibalism was resorted to. From Lan-Chau-Fu to Urumtsi, which the Chinese have made the strategic centre of their new province of Kashgaria, thirteen hundred miles have still to be traversed. The Wei, an important tributary of the Yellow River from the west, is crossed at Sien-Yang-Nsien, where it is one hundred and fifty yards wide. One of the chief graneries of Lan-Chau-Fu, which is a town of 40,000 inhabitants, has fine shops, and is in trade with Russia, is An-Ting-Nsien, at the junction of three valleys, and the others are the valleys of Ho- and Sing-Ning. Lan-Chau-Fu stands at an elevation of 5,500 feet, and the Yellow River is here 250 yards wide. Comparatively easy roads lead from Lan-Chau to Lhassa, the sacred capital of Tibet. The hilly western districts of the kingdom of Tangut did not become subject to China until about 1718. The native Tanguts much resemble the gypsies. To Su-Chau-Fu (482 miles) the road

traverses for a portion of the distance a narrow wedge of cultivation intervening between the Nan-Shan mountains and the desert, but the last portion of the way passes over a barren salt plain or on low hills. An elevation of 9,000 feet is reached from two places. Along the cultivated strips coal is plentiful; the main crops are various kinds of millets. After leaving Lan-Chau the pigs in the villages are as numerous as the men. From Sci-Chau to Ngan-Si-Fu, on the edge of the actual desert of Gobi, is 178 miles; and the town of Hami, on a small rich oasis, is 240 miles further. From Hami to Peking there is a camel route, which can be traversed by those animals in 70 to 80 days, but this is only used for the conveyance of war material. To reach Urumtsi (408 miles) the Tian-Shan mountains must be crossed at their easy easternmost pass, at an elevation of 9,000 feet. There are some fertile oases on the way. At this point Mr. Bell diverged to Tok-Sien, the most eastern town of Yakub Beg's former domain, 103 miles from Urumtsi, and on the opposite side of the Tian-Shan mountains. Between this point and Karashahar (150 miles) Lake Baghrash, a fresh-water lake with an abundance of fish, is passed. The whole of this eastern portion of Chinese Turkestan or Kashgaria is in truth nothing more than a desert, with fertile oases at intervals, each more or less thickly populated and containing a town. As we proceed westward the Turkish element commences to predominate over the Tungusian and the Chinese. Thus the fertile oasis of Khur has 2,000 Turkish families, 50 Tungusian, and 10 Chinese. Aksu, 373 miles beyond Karashahar, is the centre of a district with 180,000 people. From Aksu to Kashgar, in which district there are 160,000 families, is 310 miles. The district of Yarkand is still more populous, and is credited with 300,000 families. From the extreme length of the route from Peking to Kashgaria, the great number of days required to reach the most populated districts from the eastern seaboard, the proximity of those districts to Russian Turkestan, and the identity of race between the subjects of the two countries on both sides of the border, it seems evident that Mr. Bell is correct in his conclusion that unless China promptly constructs a railway to connect this outlying province with her main body, it must fall into the hands of Russia whenever it suits the convenience and finances of the latter to take it. Not that the Turks particularly dislike the Chinese rule, which is rather loose than severe. Several routes lead from Yarkhand to Kashmir and Hindoostan, but the Kilian route is, since the enclosure of the Mustagh, the one universally used. Before reaching Kashmir this route goes over the following passes: Kilian, 17,000 feet; Suget, 17,100 feet; Kara

Kowm, 18,500 feet; Sasir, 17,800 feet; Karawal Dawin, 14,100 feet, Kharching, 17,700 feet above sea. A considerable number of Hindoos have penetrated into Chinese Turkestan and are engaged in commerce.

Polar Regions.—The Geographical Society of Australasia has offered £5000 towards defraying the expenses of an Antarctic Expedition, and to this sum Oscar Dickson has added another £5000. Baron Nordenskjold has lectured upon the desirability of such an expedition before the Swedish Academy, but he will not himself take the command of it.

Dr. Fridtjof Nansen, who has justly achieved celebrity by his success in crossing South Greenland, has recently expounded his views respecting an expedition to the North Pole before the Geographical Society of Norway, at Christiana. Dr. Nansen stated that he believed De Long was quite correct in his idea of endeavoring to penetrate to the pole by means of the warm current that flows up Behring Strait. Three years after De Long's expedition articles belonging to the Jeannette were picked up on the west coast of Greenland. These must have drifted across by Spitzbergen, down the coast of Greenland and up the west. A piece of wood, identical in kind with that used by the natives of Alaska to make their bows, had been found on the coast of Greenland. The Esquimaux of Greenland fish up drift timber belonging to the Siberian larch, and to the red and white pines of the west coast of North America. He believed that the warm current flowed up Behring Strait, past the New Siberian Isles, across the pole, between the pole and Franz Josef's Land, and then between Spitzbergen and Greenland. The thing needed to reach the pole was to have a vessel built extraordinarily strong, and with sloping sides, so that she could not be crushed in the ice, but would be simply lifted upward by it. In such a vessel he proposed to go through Behring's Strait, then to the New Siberian Islands, and then to plow onward northward through the ice, going with the current, packed up safe, not caring for being frozen up. With few men and good, and plenty of provisions, such a course did not offer extraordinary risks. Even should the vessel be crushed, many experiences have shown that a crew can safely take to the ice. Dr. Nansen then dwelt on the scientific results, geographical, meteorological, etc., that would flow from the successful accomplishment of such a journey.

Australasia and Polynesia.—According to a convention between England and Germany, the latter power not only has possession of the northern half of the eastern part of New Guinea, but has the right to

extend its rule over all unclaimed islands in the Eastern Pacific. This gives Germany the Admiralty Isles, New Hanover, New Ireland, New Britain, the Solomon Archipelago, the Gilbert or Kingsmill Islands, the Ellice and the Phœnix groups, also the Samoan and Tongan. Complications, as is well known, have already arisen over the Samoan Island, and, as the German fleet in Pacific waters is by no means sufficient to enforce the proper treatment of white men by the natives of all these scattered groups, trouble may be expected in other quarters. No power but Germany has a right to interfere to enforce order in any of these islands, except as circumstances may compel modifications.

The Carolines.—A recently published work upon the Caroline Islands gives the results of the studies of J. S. Kubary in the Caroline group, which he first visted in 1868, as agent for the Godeffroy Museum at Hamburg. The group lies between five and ten degrees of north latitude, and stretches from 130 to 160 of east longitude. The population is rapidly diminishing, largely on account of the hiring of native labor by the whites. The current cash of these islands is for the most part formed of shells, and the natives are very particular in limiting each kind to its special purpose. Thus in Yap equal-sized disks made out the shells of the Spondylus, and polished, form a money not in use among the general public, but accumulated by the chiefs to purchase canoes or weapons to resist or attack. The Spondylus is only found in the east and north of the island of Yap, is used on this and some other isles, and is traditionally the oldest form of money—it occurs in old graves of the Ladrone chiefs. The next most valuable money consists of disks of arragonite, obtained from the Pelew Islands. These are called *palan*, and are known as "men's money." A third variety, formed of small threaded nacreous shells, is called *yar*, and known as "women's money."

In the Pelew Islands beads, called *andouth*, and probably obtained by trading, form the currency. Each variety of bead has a different value, and payments are made in specifically prescribed forms. Thus forty to fifty beads that are in the hands of one or two of the kings have a value representing £10 to £12 each. If a debtor does not possess the correct money in which to make payment, he has to borrow the right kind. Herr Kubary believes that this system must have been acquired from the Malayan States. There is a strong diversity between the textile arts, the methods of tattooing, the stature, the appearance, and the general physical characters of the natives of contiguous islands in this group.

New Guinea.—The proceedings of the Royal Geographical Society for April of this year contain Sir W. Macgregor's account of his expedition to the culminating point of the Owen Stanley range of New Guinea. On a trip to Doura, a district northwest of Port Moresby, he was told of a river named Vanapa. On April 20 he found an opening hidden in a bend of the inlet, and held his way up the river until the 27th, when the rapids became very strong, and the party were compelled to take the shore. Somewhere about this point was found a most ingenious native bridge of V-shape, at a spot where the stream was 70 yards in width. The structure was supported by a banyan-tree at one end, and by a small tree and a post at the other. The bottom was composed of four rattans, above which, at a height of about two feet six inches were two rattans on each side, and two feet three inches above these were three on one side and four on the other. The rattans were kept in position by split canes worked in. The distance between the upper rattans was about three and a half feet. Platform approaches were made at both ends.

The advantages offered by the Venapa as a basis from which to ascend the Owen Stanley range were evident, and Sir W. Macgregor resolved to avail himself of them. Considerable trouble was, however, experienced with the native porters, who objected to ascend the heights. These difficulties were at last surmounted, and the Governor, with one or two companions, eventually succeeded in following the main ridge to its culminating eastern extremity, now known as Mount Victoria. The difficulty of obtaining provisions was great, and the woods swarmed with the scrub-itch insect and with ticks, while in ground soaked with rain and warmed in the sun great numbers of leeches were encountered, of two kinds, one thin and wire-like, three-quarters of an inch in length, the other as thick as a goose-quill, and about two inches long. The mountains were found to be of slate, intersected with quartz veins. The summit called Mount Knutsford, 11,100 feet high, was reached on June 6th, and this point proved to be the best from which to follow with the eye the course of the Vanapa, which drains the entire south side of the Owen Stanley range from Mount Victoria to Mount Lilley. After a descent, the next summit, Winter Height, was ascended (11,882), then Dickson Pass (10,844) was crossed, and the highest peak (13,127–13,205 feet) was climbed. Alpine plants were not met with until within about 570 feet of the summit.

Africa.—Dr. Meyer's Ascent of Kilima-njaro.—Dr. Meyer has recently made a second and entirely successful attempt to climb the great ice-dome of Kibo, the main summit of Kilima-njaro. The principal reasons for the failure of the former attempt were the difficulties of procuring provisions sufficient for the continued stay needed, and the want of ice-axes and rope to aid in surmounting the steep wall of ice met with near the summit. To remedy the former, Dr. Meyer made friends with the young chief Mareale, of Marangu, with whom he established a camp of substantial huts for the shelter of his caravan; a second camp was formed at a height of 9,515 feet, where eight porters were left. A tent was pitched upon the saddle connecting the peaks of Mawenzi with Kibo, at a height of 14,270 feet. Each day three or four men brought provisions from Marangu to the middle camp, and two men climbed to the upper camp, so as to keep the travelers supplied. In order to conquer the ice-slope, Dr. Meyer had secured the services of Herr Purtsheller, an experienced Alpine mountaineer, provided with ice-axes and other essentials. These two spent in all sixteen days among the higher peaks, while a faithful negro stayed all the while at the upper tent. On the first occasion they left the upper camp at 2.40 A.M., and by breakfast time had left the peaks of Mawenzi below them. There was less snow (October) than had been found on the previous ascent (July, 1887). At 15,980 feet a lava dyke, with evidences of glacial action, was encountered, and the first patches of snow were found at 16,400 feet. At 17,650 feet the travelers reached the ice-slope, with an angle of 35°, conquered it in two hours, and in another hour and a quarter reached the summit-ridge, and found themselves upon the edge of an immense circular crater. The point where they stood was not the highest portion of the jagged rim, and it was not until three days later, after a return to their tent, that the travelers, using their former steps and sheltering themselves for a night in a cave, the temperature of the interior of which was 12° C., succeeded in reaching what Dr. Meyer proudly states is "probably the highest point of the German possessions." This point is estimated (by aneroid only) at 6,000 metres, or 19,684 feet. The diameter of the crater is at least 2,200 yards, and the depth of the floor 650 feet. Upon the north and east the ice descends in terraces to the bottom, but on the west and south steep lava cliffs break out of the ice-cap. In the centre a cone of brown ashes, with the top bare, rises to a height of 500 feet. The girdle of ice and snow wreathed around this cone sweeps out over a gap in the western wall of the crater-rim in the form of a glacier about a mile and a half long

(including the part within the crater), which terminates at the height of 17,900 feet. A great portion of the crater is filled with névé, assuming the form called in the Andes *nieve penitente*, from the fancied resemblance of the hardened masses left standing above the general level to the figures of kneeling penitents. The highest trace of humanity found upon the mountain was a hunter's bivouac at 15,400 feet.

Dr. Meyer made three attempts at the Mawenzi peaks, reaching a height of 16,260 feet, though he did not attain the highest pinnacle. The broken and fantastic peaks of this group surpass description in their rugged magnificence, and are evidently the skeletal remains of a volcanic crater far older than that of Kibo. On the eastern flank one looks from a precipice of 6,500 feet to the country below. Our traveler believes that the former crest of Mawenzi stood southeast of the present highest point, and that its original height approximated that of Kibo. Numerous flowers and grasses ascend the sheltered slopes of Mawenzi to a height of 15,750 feet, and elk and antelope from the northern side come over the saddle to browse upon them. The slopes on the southern and eastern side from 6,500 to 9,750 feet are covered with primeval forest, which is continued as a narrow interrupted belt on the north side of Mawenzi, but vanishes altogether on that of Kibo. Below the forest, upon the southern slope of the entire mountain, extends the fertile and well-watered plain of Ohagga; while to the north are waterless, regularly sloping plains, with grass and wild brush, inhabited by the Masai.

The mountain land of Uguene, to which Dr. Meyer took a ten days' trip after his ascent, is a gneiss range to the west of Lake Jipe. The inhabitants are known as Waguene. South of Uguene lies Usangi.

Before leaving the neighborhood, Dr. Meyer made an excursion to Madjame, previously visited by Van der Decken. On his way he traversed the districts of Uru, Kindi, Kombe, and Maruma, and crossed two large rivers, one of them the Weri-Weri, which takes its origin from the foot of the glacier that escapes from the crater of Kibo. The Ngorube draws off all the water from the melting ice of the south side of the mountain, and flows to Pangani. Dr. Meyer falls into raptures about the magnificent aspect of the mountain from Madjame, with the typical volcanic curve exhibited by its 6,000 feet of ice-cap, and with the grand ravine of the Weri-Weri leading upward to the glacier.

A map or plan and a bird's-eye view of the crater of Kibo accompany Dr. Meyer's account of his ascent in *Petermann's Mitteilungen*, 1890, Pt. I. The cone of ashes occupies a northern position in the depression, while the glacier and beds of névé fill in the southern part. The rim to the northward is swathed in ice, but the highest ice-covered peak is inferior in elevation to "Kaiser Wilhelm Spitze," on the south side, where the peaks are free from ice.

Lake Leopold.—The April issue of the Proc. Roy. Geog. Soc. contains an account of H. H. Johnston's journey to Lake Leopold, Rukwa, or Rukuga, north of Lake Nyassa. This lake is but the shrunken vestige of a much greater body of water, yet it extends much farther to the southeast, and is longer than was supposed. On its southern and western sides a level plain extends to a width of from twenty-five to thirty miles, but on the east side the mountains rise direct from the shore. The basin is girdled with mountains, and on the southeast there is a remarkable bay or inlet of the lake penetrating into them. The only affluent of the lake from the south is the Sengive, which rises near the more important Songeve, a tributary of Nyassa. On the west shore, about the middle of its length, enters the Saisi, a large river with many affluents. The lake, which swarms with hippopotami, crocodiles, and fish, is at a level of 2,900 feet above the sea. Notwithstanding the unlovely character of its shores, they are frequented by elephants, buffalo, zebra, many species of antelopes, guinea-fowl, francolins, ring-doves, etc. Nothing can be grown, and the natives live entirely by rapine or by the chase. Mr. Johnston was the first white to visit the region, and he came among them suddenly with 150 followers without asking permission.

In 1889 Dr. Abbott and T. Stevens found a stream coming from the east side of Kilima-njaro, and running into the Tsave river. They followed it upwards into a cañon, and farther still until its course was covered over by a lava-stream. They discovered a nest of small extinct craters, and among them one that held a lovely lake, bordered with palms, and containing abundance of fish, at 100 feet below its rim. Probably this is a pool in the course of the subterranean river, which is marked higher up by a streak of black lava. The lake is 3,000 feet above sea level. These travelers speak a good word for the much abused Masai, call them jolly good fellows, and deny some of the strange customs usually attributed to them.

GEOLOGY AND PALEONTOLOGY.

The Origin of Petroleum and Gas. — The following statements bring before us the principal views as to the origin of petroleum, viz:

1. Petroleum is produced by the primary decomposition of organic matter, and mainly in the rocks that contained the organic matter. Of this view, Hunt is one of the chief advocates.

2. Petroleum results from the distillation of organic hydrocarbons contained in the rocks, and has generally been transferred to strata higher than those in which it was formed. Newberry and Peckham have been quoted at length in support of this general theory. Newberry holds that a slow and constant distillation is in progress at low temperatures. Peckham refers the distillation of the petroleum of the great American fields to the heat connected with the elevation and metamorphism of the Appalachian mountain system.

These views as to the date of the origin of petroleum and gas are seen to cover almost all the possibilities in regard to the subject. Hunt believes petroleum to have been reduced at the time that the rocks that contain it were formed, once for all. Newberry believes it to have been in process of formation, slowly and constantly, since the strata were deposited. Peckham refers it to a definite and distant time in the past, but long subsequent to the formation of the petroliferous strata. He supposes it to have been stored in its subterranean reservoirs from that time to the present.

In these several statements as to origin, two questions are seen to be especially prominent, viz: What particular kinds or classes of rocks are the sources of petroleum? and, What is the value of the chemical processes involved in its production?

In answering the first question, we find the views of Hunt and Newberry distinctly opposed to each other. Hunt counts limestones the principal source of petroleum, and denies that it has been produced by distillation from bituminous shales; while Newberry finds in these shales the main source of both oil and gas, and vigorously opposes the view that limestones are ever an important source of either.[1]

It is not necessary to follow the discussion in relation to these points further. It is enough to say that in the light of present knowledge each statement is sustained as to its particular affirmations and inconclusive as to its general denials. Petroleum is undoubtedly indigen-

[1] Rept. Geol. Survey Ohio, Vol. I., p. 159.

ous to and derived from certain limestones, as Hunt has so strongly asserted. On the other hand, Newberry's doctrine that the great supplies of the Pennsylvania field are derived from Devonian shales is becoming more firmly established and widely accepted every year, though it seems likely that he has laid too much stress on bituminous shales. In other words, the theories are not incompatible with each other. Different fields have different sources. We can accept without inconsistency the adventitious origin of the oil in Pennsylvania sandstones, and its indigenous origin in the shales of California or in the limestones of Canada, Kentucky, or Ohio.

The double origin of petroleum from both limestones and shales—and it is not necessary to exclude sandstones from the list of possible sources—deserves to be universally accepted. In confirmation of this double origin, it is coming to be recognized that the gas and oil derived from them two sources—limestones and shales—generally differ from each other in noticeable respects. The oil and gas derived from limestones contain larger proportions of sulphur and nitrogen than are found in the oil and gas of the shales. Nitrogen renders the oils unstable, and sulphur compounds impart to them a rank and persistent odor from which they can be freed only with great difficulty. In the case of the oil-bearing shales of California, the petroleum is evidently derived from the animal remains with which the formation was originally filled. In composition this oil agrees with the limestone oils already described. It contains more than four times as much nitrogen as the Mecca oil of northeastern Ohio, and its percentage of sulphur is very high. Peckham says of the Pennsylvania oils:[2]

"The exceedingly unstable character of these petroleums, considered in connection with the amount of nitrogen that they contain and the vast accummulations of animal remains in the strata from which they issue, together with the fact that the fresh oils soon become filled with the larvæ of insects to such an extent that pools of petroleum become pools of maggots, all lend support to the theory that the oils are of animal origin."

He speaks again of this class of petroleums as formed of animal matter that has not been subjected to destructive distillation.[3]

It now appears as if oil and gas derived from animal remains can be distinguished from those of the bituminous shales by the characters above described. Certain it is that the "limestone oils" differ in physical characteristics from the Pennsylvania oils, for example, in a

[2] Op. Cit., p. 69.

[3] Ibid., p. 71.

marked degree. They are dark in color; they are heavy oils, their gravity generally ranging from 34° to 36° Beaumé, though sometimes falling to 40° or even 42°; they have a rank odor, arising from the sulphurous compounds which they contain. The oils of Canada, Kentucky, Tennessee, and of the fields in northwestern Ohio all agree in these respects, and the oil and gas of the Utica shale and Hudson River group of the state fall into the same category.

In the preceding statements the organic matter of the bituminous shales has not been positively referred to a vegetable source. Such a source is highly probable, but it cannot be said to be fully demonstrated until the origin of the so-called *Sporangites* of the shales is finally determined. There are a few geologists who are inclined to refer these forms to hydroid zoophytes (animal) rather than, with Dawson, to marine rhizocarps (vegetable). Whatever their origin, they give rise to petroleum and oil of a definite character, which is in marked contrast to that of the limestone oils.

Which of these theories as to the mode and time of origin of petroleum has the most to commend it?

In conclusion, a few of the previously stated propositions in regard to the origin of petroleum that seem best supported will be concisely summarized:

1. Petroleum is derived from organic matter.

2. It is much more largely derived from vegetable than from animal substances.

3. Petroleum of the Pennsylvania type is derived from the organic matter of bituminous shales, and is of vegetable origin.

4. Petroleum of the Canada and Lima type is derived from limestones, and is of animal origin.

5. Petroleum has been produced at normal rock temperatures (in Ohio fields), and is not a product of destructive distillation of bituminous shales.

6. The stock of petroleum in the rocks is already practically complete.—*Edward Orton in Ann. Report U. S. Geol. Survey, 1886–'87. (Published 1890).*

Production of Salt in the United States.—In 1887 the production of salt in the United States was 7,831,962 barrels of 280 pounds each. Of this, the value was estimated at $4,093,846. Michigan produced 3,944,309 barrels; New York, 2,353,560 barrels; Ohio and West Virginia, about 600,000; Kentucky, Tennessee, and Virginia, about 200,000; or about 7,000,000 barrels in all produced from the evaporation of brines. In addition, Louisiana produced 225,000 bar-

rels from the quarries of rock salt at New Iberia; Utah, 325,000 barrels, mostly from the waters of Salt Lake, but a small portion from the quarries of rock salt in Jaub and Sevier counties. California produced in former years over 200,000 barrels, chiefly from the evaporation of sea-water in San Francisco Bay, but in 1887 the production was only 28,000 barrels, in consequence of a combination of the operators to reduce the output and enhance the price.

In Kansas a discovery of rock salt has recently been made, which promises to be an important addition to the resources of the State. The salt beds lie near the base of the Trias, and occupy a large area in the southern portion of the State, extending into Texas. In seven localities cited by Mr. Robert Hay, in the biennial report of the Kansas State Board of Agriculture, the rock salt lies at depths varying from 450 to 925 feet, and the thickness is from 75 to 250 feet. The production in 1888 was about 2,000 barrels.

In New York the production of salt is about equally divided between the reservation at and about Syracuse and the Warsaw district in Western New York, the latter having increased with great rapidity. The salt from the Onondaga Reservation is obtained from the evaporation of the brine of about 40 wells; these wells have an average depth of 330 feet, and the strength of the brine is about 70 per cent. of the salometer.

In the Warsaw district there are about 50 wells in operation, from 800 to 2,500 feet in depth. According to the report of Dr. F. E. Englehart the entire production in 1887 was 6,072,000 bushels.

The well at Piffard, belonging to the New York Salt Company, is producing rock salt, and is the pioneer enterprise of this kind in the State. The first bed of salt was reached at a depth of 938 feet. This bed is two feet in thickness, and is separated from the second bed, 12 feet in thickness, by 4 feet of shale. The third salt bed was 6 feet thick and 28 feet below the second; and the fourth bed, 9 feet below the third, was 58 feet in thickness.—*J. S. Newberry, in Transactions of the N. Y. Academy of Sciences, Nov., 1889.*

Geological News.—General.—O. Feistmantel, in his account of the geology of South Africa, parallels the Karroo formation with the Gondwana of Hindustan. The upper beds of this formation he considers equivalent to the Mesozoic coal-measures of Eastern Australia, the middle Karroo to the Hawksbury beds, and the lower Karroo to the upper coal-beds and upper marine beds, which last are probably representative of the Permian and Carboniferous of general geology, so that the upper and middle Karroo may represent respec-

tively the Lias and the Trias. The cape formation is paralleled with the Vindhya of Hindustan, which probably represents the lower Carboniferous and Devonian. The South African primary includes metamorphic and archaic.

The Imperial Geological Survey of Japan has publised a reconnaissance map, scale 1–400,000; sectional maps, scale 1–200,000; and agronomic maps of twice the latter scale. The reconnaissance sheets comprise North Japan between 138° E. and 38° N., and N. Japan from 38° to 40° N., while the sectional maps include the provinces of Shikoaka, Fuji, Kofu, Veda, Nagano, Izu, Yokohama, Tokio, Mayebashi, Nikko, Kakusa, Chiba and Mito. T. Harada, writing of the geotectonic "membering" of Japan, states that the outer oceanic curve of the islands, though poor in volcanoes, is rich in seismic activity, while the inner side is rich in recent eruptive masses, active volcanoes and thermal springs. The Japanese Sea is a great "Kesselbruch" (chaldron-fissure), and the archipelago is its eastern border.

Palæozoic—The *Geological Magazine* for March, April, and May of this year contains notes on the palæontology of Western Australia. A. H. Foord describes the gastropods, brachiopods, etc., including the new species of Spirifera, while G. J. Hinde gives the corals and polyzoa, with a new genus of the former.

In a recent number of the *Quar. Jour. Geol. Soc.* T. Rupert Jones describes many new species of palæozoic Ostracoda from North America, Wales, and Ireland.

G. J. Hinde describes (*Quar. Jour. Geol. Soc.*, Feb. 1, 1890) a new genus of siliceous sponges from the lower calcareous grit of Yorkshire, and names it Rhaxella. Small globules of silica take the place of elongated spicules in this sponge.

Mesozoic.—In the Wealden near Hastings Mr. R. Lydekker identifies five distinct species of Iguanodon, viz: *I. bernissartensis* Dollo, *I. mantelli*, *I. dawsoni* Lyd., *I. fittoni* Lyd., and *I. hollingtoniensis* Lyd. He also maintains the existence in the English Wealden of two species of Megalosaurus, one of which is *M. dunkeri*, while the other is yet undescribed.

Comoliosaurus (*Pliosaurus*) *portlandicus* has been proved to range upwards to the middle Purbeck.

G. Cotteau has commenced the study of the cretaceous echini of Mexico on six species collected by S. R. Castillo, the director of the

mines. Three of these forms, *Pseudocidaris saussurei* Loriol, *Holectypus castilloi* Cotteau, and *Heteraster mexicanus*, are peculiar to Mexico, but the three others have previously been found outside of that country. *Diplopodia malbosi* is common enough in France in the aptian, as is also *Salenia prestnesis* Desor. *Laniera lumen*, from the higher cretaceous beds, is sufficiently common in Cuba.

According to M. A. de Grossenore, the callovian beds east and west of the primitive mass of La Vendee have some fossils, unlike those of the Paris basin, but like those of the callovian of the Alps and Carpathians. *Terebratula antiplecta* occurs here, and is also found in the Tyrol and in Galicia. There also occur Terebratulæ of the groups *nucleata* and *bivallata*, and *Rhynchonella acutiloba*. The callovian of Cape Mondago (Portugal) is analogous.

Tertiary.—The discovery of a new mandible of Dryopithecus has recently led M. A. Gaudry to compare it with the lower jaw of man and of the existing apes, with the result that it proves to be inferior in type, not only to the former, but to most of the latter. The lengthened jaw and the contracted space left for the tongue are the two points chiefly dwelt upon. In these respects the gorilla is below the orang, which again is inferior to the chimpanzee. M. A. Milne-Edwards stated that the Dryopithecus was nearer to the gorilla than to any other existing ape, and that the prognathism of the jaw was so excessive that one might suppose the animal to have been quadrupedal.

A giant example of a fossil tortoise, with a carapace five feet and a half in length and rather more than three feet nine inches wide, has been discovered by M. Deperet in the red clays of the upper Miocene of Mont Leberon. Portions of this species had been previously found by M. A. Gaudry, but the present specimen was in astonishingly complete preservation, the body standing nearly in a natural position in the side of a ravine. The carapace was somewhat crushed with the superincumbent weight. This tortoise is larger than any other known living or fossil form except *T. atlas* of the Himalayas. It is, however, so very near in all important characters to *Testudo perpiniana*, which occurs in the environs of Paris, and has been found with a length of four feet, that it may probably be best regarded as a variety of that species. Though *T. perpiniana* is of Pliocene age, and the new fossil was found in the uppermost beds of the Miocene, the resemblance is great.

In a recent issue of the *Quarterly Journal* of the Geological Society of London, Mr. R. Lydekker treats of the presence of the Striped Hyæna in the Pliocene beds of the Val d'Arno, describing the remains in answer to the assertion that they belonged to *H. crocuta*. It is curious that these two species do not now exist in the same localities, though in ancient times they seem to have done so; also that they have to a considerable extent interchanged their localities.

Recent.—Capt. A. W. Stiffe recently read a paper before the Geological Society of London concerning the glaciation of the Sind and Jhelam valleys in the Himalayan mountains of Kashmir. He stated his belief in the gigantic character of the ancient glaciation and gave a general description of the features of the Sind valley and of the existing glaciers near Sonawarg. At this point there are snow fields at a lower level than the foot of the glacier, which is rather unusual. Very perfect typical older terminal moraines exist at Sonawarg, some of them four miles below the present termination of the glaciers, and at an elevation of 10,000 feet. These once blocked up the Sind River, and the sections cut by the rivers through these moraines are remarkable. The glaciated appearance of the gorge below Sonawarg is very striking, and the entire Sind valley presents a continual succession of moraines. The hillsides of the valley exhibit a comparatively rounded outline to a height of 2000 feet or more, while above this they are rugged.

The existing lakes of the Kashmir district were referred by the writer to glacial action—they were the remains of a former much more extensive alluvial lake which had been largely silted up; he then treated of the supposed glacial deposits of the Jhelam valley, and stated that the whole valley from Baramilla to Mozufferabad contained extensive glacial or moraine deposits. In conclusion attention was drawn to the great deposits of travelled granite blocks at Rampoor, blocks which from their size, and from their difference from the neighboring rocks, must certainly have been carried thither by the action of glaciers.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A contribution to the knowledge of the geology of South America has recently been made by Bergt[2] through the study of thin sections of rocks collected in the Sierra Nevada and the Sierra de Peryá in the United States of Columbia. Bergt has confined himself to a description of a large number of rocks that were collected by others, and therefore he has not been able to do more than indicate the interesting results which follow from a close study of their thin sections. Among the facts of general interest discovered may be mentioned the formation of secondary epidote from augite and olivine in melaphyre, and the production of an epidosite therefrom; the occurrence of lamellæ in uralite of syenite, that have became curved through the pressure exerted upon them by a feldspar crystal during its growth; the existence of a rim of brown hornblende around a grain of uralite, and the occurrence of secondary brown mica as a product of the alteration of augite. The writer also discusses the nature of uralite, and suggests that the name uralitite be used as a comprehensive one for those rocks containing secondary hornblende, whose original nature cannot be determined.——Goller[3] describes in a very careful article a number of lamprophyre dykes cutting gneiss and crystalline schists in the Vorspessart in Germany. The crystalline schists consist of dioritic and "augen" gneisses, produced by pressure from eruptive rocks, and other gneisses; the history of whose origin is unknown. They are cut by dykes of camptonite and kersantite, whose characteristics are minutely described by the author. Both contain large quartz and orthoclase grains that are supposed to be the remnants of dissolved inclusions, and smaller quartzes that have crystallized from the magma. Two varieties of augite were observed; one alters into talc and tremolite through green hornblende, and the other into serpentine through the same intermediate product. The original quartz is supposed to owe its origin to the physical conditions prevailing during the solidification of the rock mass—principally pressure and the presence of water.——Still other instances of the occurrence of young rocks with the characteristics of old ones are described by Reiser[4] from four localities in the northern Alps. They are typical diabases and diabase porphyrites of Eocene age. They con-

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] *Min. u. Petrog Mitth.*, 1889, X., p. 271.
[3] *Neues. Jahrb. f. Min.*, etc., B. B. VI., p. 485.
[4] *Min. u. Petrog. Mitth.*, X., 1889 p. 500.

sist of plagioclase, augite, apatite and secondary substances, and occur with the typical structure of granular and aphanitic diabases. They are characterized by the zeolitization of the plagioclase. Among the zeolites formed are natrolite and analcite, of which the latter has been separated and identified by chemical means.——Thin veins of diabase with tachylite borders have produced fusion along the edges of the slates through which they cut. According to Rutley[5] the glassy rim produced by the fusion is darker in color than the tachylite selvages of the dyke rock.——N. H. and H. V. Winchell[6] propose a new theory for the origin of the iron ores of Minnesota, in opposition to the iron carbonate theory[7] of Irving. The new theory follows the same lines as does Hunt's crenitic hypothesis. It is based entirely on theoretical suppositions, which, so far as is known, can have little foundation in facts.

Mineralogical News.—*Rare Minerals.*—In an article on the minerals of Fiskernäs, in Greenland, Ussing[8] has given the crystallographic and optical properties of several rare minerals. *Sapphirine* has for its axial ratio $a : b : c = .65 : 1 : .93$. $\beta = 79° 30'$. The axis of least elasticity is inclined 8° 30′ to the vertical axis, and $2V_{na} = 68° 49'$. The indices of refraction are $\alpha = 1.7055$, $\beta = 1.7088$, $\gamma = 1.7112$. The mineral is negative, and is pleochroic with A colorless, and B and $C =$ blue, or $A =$ light greenish blue, $B =$ dark bluish green, and $C =$ yellowish sap green. An analysis of the mineral yielded:

SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	Loss
12.83	65.29	.93	.65	19.78	.31

Kornerupine is orthorhombic with $a : b = .854 : 1$. It has a specific gravity of 3.273, is colorless in thin section, and has $\infty P\bar{\infty}$ as the plane of its optical axes, with c the acute bisectrix, which is negative. The optical properties of *gedrite* and *pargasite* are also investigated. In a few general remarks on the properties of the former mineral the author states that it is more probable that the optical angle of the orthorhombic hornblendes increases with the increase in the percentage of silica rather than with the increase of iron.——*Atelesite*, analyzed by Busz,[9] yielded:

As_2O_5	Bi_2O_3	Fe_2O_3	H_2O
14.12	82.41	.51	1.92

[5] *Quart. Jour. Geol. Soc.*, 1889, p. 626.
[6] *American Geologist*, Nov. 1889, p. 291.
[7] AMERICAN NATURALIST, Dec., 1886, p. 1050.
[8] *Zeits. f. Kryst.*, 1889, XV., p. 596.
[9] *Zeits. f. Kryst.*, 1889, XV., p. 625.

The axial ratio, recalculated from von Rath's measurement, is $a:b:c=.9297:1:1.5123$. $\beta=69° 35'$. New measurements by Busz gave $a:b:c=.9334:1:1.5051$. $\beta=70° 43'$.——*Kobellite*, from the Silver Bell Mine, Ouray, Colorado, has been analyzed by Kellar.[10] Its composition is:

S	Bi	Sb	Pb	Ag	Cu	Fe	Zn	Gangue
18.39	28.40	7.55	36.16	3.31	2.59	1.50	.39	.45,

which may be represented by $2(Pb.Ag_2Cu_2)\,S.(BiSb)_2S_3$. It differs in composition from the mineral called kobellite by Rammelsberg (Pb_3BiSb_6), but is like that to which the name was first given by Selterberg. The same author suggests the name *lillianite* for a substance of the composition $3(PbAg_2)\,Bi_2S_3$ described by himself[11] several years ago.——*Nivenite* is a rare mineral associated with fergusonite and gummite at the gadolinite locality in Llano County, Texas. It is described by Genth[12] as velvety black, with a brownish streak. It is easily soluble in nitric acid, and possesses the composition:

UO_3	UO	ThO_2	Y_2O_3, etc.	Fe_2O_3	PbO	Ign	Ins	Sp Gr
46.75	19.89	7.57	11.22	.58	10.16	2.54	1.22	8.01

It is allied to bröggerite ($3RO.UO_3$) and clevéite ($6RO.2UO_3.3H_2O$) in containing a large proportion of uranium. Its hardness is 5.5, and its composition is represented by ($9RO.4UO_3.3H_2O$). Two varieties of *fergusonite* have been found in the same locality. The first corresponds to $Cb_2O_5.R_2O_3.H_2O$, and the second to $Cb_2O_5.R_2O_3.3H_2O$. The two are closely associated. The first is probably tetragonal, with a bronzy lustre on a fresh fracture. It is infusible, decrepitates when heated, and changes to an olive green color. The second variety is deep brown in color. Its streak is greenish gray. Upon ignition it turns light brown but does not decrepitate.——*Hydrocerussite* ($2PbO_3 + Pb(OH_2)$, corresponding to azurite among the copper salts, has been produced by Bourgeois,[13] by acting upon lead acetate with ammonium carbonate. The little crystals thus formed have all the properties of the natural substance. By means of them the composition of the mineral has been determined. The white lead of commerce is found by the author to be a mixture of two substances with the composition respectively of cerussite and hydrocerussite.——*Percylite* and *caracolite* are briefly mentioned by Fletcher[14]

[10] *Zeits. f. Kryst.*, 1889, XVII., p. 67.
[11] *Jour. Amer. Chem. Soc.*, Vol. VII., No. 7.
[12] *Amer. Jour. Sci.*, Dec. 1889, p. 474.
[13] *Bull. Soc. Franc. d. Min.*, XI., p. 221.
[14] *Min. Magazine*, 1889, p. 171.

as among the many lead salts produced by the decomposition of bournonite and galena at the Mina Beatriz, Sierra Gorda, Chili.

Miscellaneous.—Pseudomorphs of talc after quartz, magnesite and calamine are found not uncommonly in a talc layer at Göpfersgrün, near Wunsiedel in the Fichtelgebirge, near a contact of granite and limestone, that has suffered dolomitization as the result of the action of magnesian solutions emanating from the eruptive rock. The genesis and growth of the talc pseudomorph after quartz are carefully described by Weinschenck[15] as taking place in the following manner. The quartz crystals are first traversed by numerous capillary cracks, running parallel to the prismatic faces and rarely parallel to the rhombohedral planes. Along the sides of these, little plates of talc are developed. From certain points within the crystal other fissures then begin to form, and along the sides of these more talc is formed, until finally there remain only a few isolated areas in which the original mineral can be detected. The production of the new mineral along the cracks leads to the supposition that the change is due entirely to the medium of circulating water, a view that is substantiated by experimental researches.——An important contribution to the discussion of optical anomalies has been made by Erb[16] in a study of sodium acetates of copper, magnesium, nickel, and other metals. When allowed to crystallize slowly these salts form at first uniaxial crystals belonging to the hexagonal system. As they increase in size the crystals become twinned according to certain orthorhombic laws. In thin section they show twinning lamellæ, which disappear when the temperature is raised to 65°. The etched figures produced in both the simple and twinned crystals are of the same shape. They lie in the same relative positions, and are not symmetrically developed about the twinning planes of the lamellæ, but they have the symmetry belonging to the hexagonal system. The twinned crystals are pyroelectric, but upon assuming the isotropic condition they lose this property entirely. To account for these anomalies the author thinks that a strain has been superinduced in them during their growth. If they are mimetitic forms it is odd that the crystals should possess a certain grade of symmetry when small, and assume it again when heated.——Upon treating freshly precipitated ferric hydroxide at 250° with water, to which a trace of ammonium fluoride has been added, Bruhns[17] obtained little plates of *hematite* with hexagonal cross sections. Freshly precipitated alumina

[15] *Zeits. f. Kryst.*, XIV., p. 305.
[16] *Neues Jahrb. f. Min.* etc., B. B. VI., p. 121.
[17] *Neues. Jahrb. f. Min., etc.*, 1889, II., p. 62.

when treated in the same way at 300°, yielded little crystals of *corundum* with pyramidal terminations. *Quartz* crystals with rhombohedral terminations were produced by heating pulverized glass or amorphous silica to 300° under the same conditions. Microcline gave *tridymite* plates. A mixture of metallic iron, iron oxide and amorphous silica produced litte black amorphous plates of *ilmenite* and crystals of *magnetite*. The syntheses are of importance as indicating the possibility of the formation of contact minerals at a low temperature in the presence of traces of fluorine.——Johnston[18] has subjected muscovite and biotite to the action of pure water and to that of dilute carbonic acid for the length of one year. The *muscovite* undergoes no change in this time except slight hydration, in consequence of which it becomes a hydro-muscovite resembling margarodite in composition. Biotite during this time becomes bleached under the influence of the carbonic acid. It loses some of its magnesium and iron, assumes water, and passes like the muscovite into a hydromuscovite. Anhydrous micas when they undergo hydration increase in bulk, a fact that may help to explain the cause of the rapid weathening of micaceous sandstones.——Bruhns[19] has succeeded in obtaining genuine *glass inclusions* in quartz by heating in a bath of molten granite specimens of phrase and pieces of quartz containing inclusions of fibrolite. The resulting glass is entirely surrounded by quartz, and is not merely a portion of the granitic substance filling cracks produced in the mineral by heating. The inclusions are arranged in straight and curved lines, and have all the properties of inclusions found in porphyritic quartzes.——A brief comparison of the shapes of the etched figures in diopside and spodumene is made by Greim[20]. The depressions found on the ∞ P faces of the first mineral are nearly triangular, with their apices inclined toward the positive hemi-pyramid.——Mr. Lane[21] describes a method of determining the values of the optical angles of minerals in thin sections of rocks without the use of converged light.

[18] *Quart. Jour. Geol. Soc.*, May, 1889, p. 363.

[19] *Neues. Jahrb. f. Min., etc.*, 1889, I., p. 268.

[20] *Miner. Magazine*, May, 1889, p. 252.

[21] *Amer. Jour. Sci.*, Jan., 1890, p. 53.

BOTANY.

Some Elementary Botanies.—That there is a dissatisfaction with the commoner methods of teaching botany as set forth in the text books, is indicated by the numerous attempts of various teachers to give us better books. In no other science is there to-day such diversity of opinion as to the best method of introducing the pupil to the subject to be studied. As a result we have a multiplication of elementary books, each designed to lead the pupil into his work by a different route. For twenty years the little books by Miss Youmans have stood as a sort of protest against mere "book botany." Though faulty in many particulars, they were valuable in showing that there are other ways of teaching botany than the stereotyped ones. A recent book, "Descriptive Botany," by the same author, has much in it to commend. At the very beginning the pupil is told to supply himself with his own material for examination. He is told to "gather a variety of leaves; and to begin their study by comparing them," etc., etc.* Further on we find this: "Pull up any herb which has a distinct stem, and compare the stem with the root," and so on repeatedly. This is excellent, and the pupil cannot fail to be greatly benefited by such a course. There is too marked an emphasis given to technical terms, which are needlessly printed in italics, and too frequently there is a dictionary-like brevity, as when we read that "The leaf of a fern is called a *frond*," and "The stalk or petiole of a frond is called a *stipe*." Why this is so is not hinted. The "Popular Flora" is just what it pretends to be—popular—and will be useful to the beginner who has prepared himself aright to take it up. It contains brief but plain descriptions of the more common flowering plants including cultivated as well as wild species. It is pleasant to note that the Gymnosperms are assigned to their proper place between Angiosperms and the Pteridophytes. It is not so pleasant, however, to note that the explanation of the structure of the flowers of the Conifers (the sole representatives of the Gymnosperms) is wholly erroneous. There has been an attempt to carry the old and discarded ideas as to floral structure over into the new classification. The Conifers as described in this book should go back into their old position, sandwiched between the Monocotyledons and Dicotyledons!

In many points the "High School Botany," prepared by H. B. Spotton for the use of Canadian students, has a considerable resem-

blance to Miss Youmans's work noticed above. There is the same admiration and following of Henslow's "schedules" for analysis, the same examination of representative plants, while in each there are several chapters given to generalizations. Most of the work of preparing this volume appears to be well done, but there are evidences here and there of haste. Thus while the true nature of the lichens is recognized on page 202, a little further on (p. 206) we have the old statement that "the lichens, from their peculiar constitution, may be regarded as transitional between the Algæ and the Fungi." Here we have a little new wine (p. 202) in a very old bottle (p. 206). The "Flora for the Use of Beginners" in this book is much like Miss Youmans's "Popular Flora." It is really a very useful little manual.

A recent English book, Edmonds's "Elementary Botany," has been placed before the American public by Longmans of New York. It is a much more scientific book than either of the preceding, although like them it teaches botany by observation. The principal difference is that the observation in this book is more profound, and is directed to essential rather than to superficial characters. The student is brought to study the plant as a living thing, rather than an object to be classified and labeled. We find that while 153 pages are given to structure and physiology, but 35 are devoted to classification. A few orders are selected, and in each a typical plant is suggested for study, while a few others are cited as common examples. The book is a very good one.

Dr. Campbell's "Structural and Systematic Botany," which has recently been brought out by Ginn & Co., is an attempt to supply a small and handy introduction to all parts of the vegetable kingdom. It is based upon, and to a certain extent is an abridgement of, Goebel's "Outlines of Classification and Special Morphology of Plants," a work of great usefulness to the student in spite of its considerable cost. This introduction will be welcome to many a teacher and student who cannot afford the larger work.

After a few introductory pages devoted to methods of work, and a brief examination of the cell, the Protophytes are taken up, nine pages being devoted to them. Then follow in order the Algæ, Fungi, Bryophytes, Pteridophytes, and Spermaphytes. Very good outline drawings, largely original, accompany the text. A commendable feature of the work is the adoption of Eichler's arrangement of the flowering plants.

Here and there slips, due doubtless to haste, are noticed. Thus the figures B, C, and D, on page 132, are certainly not of "year-old cones of Scotch Pine," and on page 131 the relation of scale and "ovule-bearing leaf" are badly confused. There is also a looseness in

the quotation of the titles of works of reference and the names of authors and publishers on pp. 235-6. We note further that Ustilago is persistently spelled Ustillago.—CHARLES E. BESSEY.

The Completion of Saccardo's Sylloge Fungorum.—Eight years ago the first volume of this great work appeared, and this has been followed by others in rapid succession until now we have the eighth and final volume of the series. In these thick volumes, which aggregate more than eight thousand pages, nearly thirty-two thousand species have been described (exactly, 31,927). The completion of so great a labor in so brief a space of time must excite at once our wonder and admiration. We have here a work of vast extent, whose first and last volumes are near enough together in time, so that they are not appreciably separated by any change in plan, due to a change of view on the part of the authors. Whatever we may say of the plan of the work, and however much we may wish that a different one had been adopted, it is comfortable to know that here at least is a book completed upon the lines laid down by its author less than a decade ago. It is cheerful, also, to think that a generation has not died during the publication of the work, but that nearly all who saw its beginning have seen its completion. Thus the depressing influence of De Candolle's "Prodromus," dragging its way through fifty years to incompletion, is counteracted, and we may again hope to see great undertakings inaugurated.

If we take the great masses of families as worked in this book, and make a distribution in an approximately natural system, we get a better idea of the numbers and extent of the fungi. For convenience of reference the number of species in each family is given, and the total number in each order or class.

PROTOPHYTA.

MYXOMYCETEÆ.—(Vol. VII.)—Monadinaceæ, 49 species; Sorophoraceæ, 9; Myxomycetaceæ, 383. Total, 441 species.

SCHIZOPHYTA.—Schizomycetaceæ, 659 species. (Vol. VIII.)

ZYGOPHYTA.

CONJUGATÆ.—Protomycetaceæ, 19; Chytridiaceæ, 132. (Vol. VIII.); Entomophthoraceæ, 20; Mucoraceæ, 200. (Vol. VII.); Total, 371 species. (Vol. VII.)

OÖPHYTA.

CŒOELOBLASTEÆ.—Saprolegniaceæ, 80; Peronosporaceæ, 96. Total, 176 species. (Vol. VII.)

CARPOPHYTA.

ASCOMYCETEÆ.

PYRENOMYCETEÆ.—(Vols. I., II., and Add.)—Perisporiaceæ, 481; Sphæriaceæ, 5448; Coryneliaceæ, 2; Hypocreaceæ, 640; Dothidiaceæ, 351; Microthyriaceæ, 65; Lophiostomaceæ, 213; Hysteriaceæ, 372; Hermihysteriaceæ, 3. Total, 7575 species.

HYPODERMEÆ.—(Vol. VII.)—Uredineæ, 1224; Ustilagineæ, 284. Total, 1508 species.

— ? —

Phymetosphæriaceæ, 16; Onygenaceæ, 6; Laboulbeniaceæ, 15. Total, 37 species. (Vol. VIII.)

SPHÆROPSIDEÆ.—(Vol. III.)—Sphærioidaceæ, 3690; Nectrioidaceæ, 44; Leptostromaceæ, 203; Excipulaceæ, 143. Total, 4080 species.

— ? —

Melanconiaceæ, 606 species. (Vol. III.)

HYPHOMYCETEÆ.—(Vol. IV.)—Mucedinaceæ, 1147; Dematiaceæ, 1579; Stilbaceæ, 344; Tuberculariaceæ, 594. Total, 3664 species.

SACCHAROMYCETEÆ.—Saccharomycetaceæ, 30 species. (Vol. VIII.)

DISCOMYCETEÆ.—(Vol. VIII.)—Caliciaceæ, 78; Gymnoascaceæ, 51; Cordieritaceæ, 5; Patellariaceæ, 161; Phacidiaceæ, 268; Sticteæ, 229; Bulgariaceæ, 152; Dermateaceæ, 255; Ascobolaceæ, 130; Pezizaceæ, 1948; Heloellaceæ, 169; Cyttariaceæ, 7. Total, 3453 species.

TUBEROIDEÆ.—(Vol. VIII.)—Elaphomycetaceæ, 21; Cenoccocaceæ, 1; Tuberaceæ, 102; Endogonaceæ, 6. Total, 130 species.

BASIDIMYCETEÆ.

GASTEROMYCETEÆ.—(Vol. VII.)—Hymenogastraceæ, 78; Lycoperdaceæ, 426; Nidulariaceæ, 61; Phallaceæ, 81. Total, 646 species.

HYMENOMYCETEÆ.—(Vols. V. and VI.)—Tremellaceæ, 258; Clavariaceæ, 371; Thelephoraceæ, 884; Hydnaceæ, 427; Polyporaceæ, 1972; Agaricaceæ, 4639. Total, 8551 species.

There are thus 1100 species of Protophytes; 371 of Zygophytes; 176 of Oöphytes, and 30,280 of Carpophytes. Of the latter again there are 12,703 Ascomyceteæ; 9,197 Basidiomyceteæ, with 8,380 probably, but not certainly, imperfect stages of the former.

CHARLES E. BESSEY.

The Preparation of Vegetable Tissues for Sectioning on the Microtome.—Vegetable tissues vary so much as to the amount of protoplasm, cellulose, and other substances contained, that the

methods used for obtaining good sections from them must vary greatly. I have prepared and sectioned fungi, lichens, the cotyledons, plumules, hypocotyledonary stems, roots, and root-tips of the cucumber, young pine cones, young wheat blades, lilac buds, and bean stems, with varying degrees of success.

Lichens, and the young firm cotyledons of the cucumber could be dehydrated, and permeated with paraffine much more rapidly than young meristemic tissue, or tissue composed largely of cellulose and water. The former may be placed in 50 per cent., 75 per cent., 90 per cent., and 100 per cent. alcohol, chloroform, chloroform and paraffine, and finally in paraffine, at a temperature of 55° C., remaining in each from two to twelve hours, and good results may be obtained.

But the meristemic and the thin-walled watery tissue must be treated differently, or the tissue will come through very much shrunken and distorted—worthless biologically.

I have had the most success following the method described by Dr. J. W. Moll, in the *Botanical Gazette* for January, 1888. I have obtained good sections from all the material that I have treated in this way. I used a 1 per cent. solution of chromic acid and 20 per cent., 35 per cent., 50 per cent., 75 per cent., and 90 per cent. alcohols for dehydrating. The chromic acid seems to fix the protoplasm, and macerate the cellulose, allowing the alcohols to pass more freely. I allowed the specimens to remain in the several per cents. of alcohol from two to twenty-four hours, according to their size and texture. As as rule, I found that the more gradually the specimens were dehydrated the better. From absolute alcohol, the specimens were placed in a solution of equal parts of turpentine and paraffine. The solution containing the specimens was then raised gradually from a temperature of 20°+ C. to about 45° C. They were then placed in melted paraffine, kept as nearly at 50° C. as possible. Small specimens will be permeated in one or two hours, but large specimens require from four to six hours.

From the 75 per cent. alcohol I placed the specimens in a stain. The stains I tried were alum cochineal, hæmatoxylin, fuchsin, methyl green, methyl blue, methyl violet, and ammonia carmine. I found alum cochineal a good stain for fungi, plumules, stems, roots, and root-tips, but it would not penetrate the cucumber cotyledons, Fuchsin would penetrate anything I tried; but as it is soluble in alcohol it is necessary to over-stain the specimens, and then allow the coloring to come out until it is about right. Hæmatoxylin stained all the tissue that I tried except the young cucumber cotyledons. This stain gives

large specimens a dark blue color on the outside, and a purplish pink color on the interior. The nuclei and the cell walls are brought out clearly. I did not have good success with the methyl colors, as they were easily dissolved out by the alcohol.

If specimens have not taken sufficient color, or if the alcohol has removed too much of the color, sections can be stained upon the slide, after they are cut. Any stain can be used, but none that I tried differentiated the parts sufficiently. Fuchsin will give enough color in a few seconds. The sections must stand in hæmatoxylin from two to ten minutes, and in alum cochineal from ten to twenty minutes. If it is intended to stain upon the slide, an alum fixative will be found better than collodion.

I heated the slides in the gas flame to melt the paraffine, and poured on turpentine to wash it out. The specimens were then mounted in balsam dissolved in chloroform. Air bubbles that appear when sections are first mounted, will disappear after the slides stand a few hours. If the razor or knife used for cutting is very sharp, small specimens may be cut 1-2500, or even 1-5000 of an inch in thickness. But larger specimens cannot be cut more than 1-600 to 1-1500 of an inch thick without crowding the tissues together, and giving them the appearance of being shrunken.—A. J. McClatchie, *Lincoln, Neb.*

ZOOLOGY.

The Ontogeny of Limulus.—The following is preliminary to a more detailed account, with ample illustrations, which will be published soon. The work was done in the Marine Biological Laboratory at Woods Holl, Mass., during the summers of 1889 and 1890. In my views of the earlier stages, as seen from the surface, I fail to corroborate Osborn's account[1] in many particulars. The eggs were artificially fertilized, and were carried through until hatching.

(1) The segmentation nucleus is subcentral, and is surrounded by a thin pellicle of protoplasm. It undergoes several divisions before any signs of segmentation are visible from the surface. The products of this division migrate more rapidly toward that pole of the egg where the germ is subsequently to appear than to any other portion of the surface. Forty hours after impregnation the egg itself begins to segment, and this segmentation has in its general appearance a meroblastic character,

[1] Johns Hopkins University Circular, No. 43, 1885.

recalling to a slight degree Metschnikoff's,[2] Pl. XIV., Fig. 5. The result of this yolk segmentation is to divide the egg into a number of yolk cells, in the center of each of which there is a nucleus with its thin layer of protoplasm.

(2) The result of migration of the products of egg and nuclear segmentation is the formation of a blastoderm at first on one side of the egg, the cells of which are smaller and less charged with yolk than those of the rest of the ovum. At this time surface views show no traces of regularity. At one pole are numbers of poorly-defined small cells, while at the other the cells are greatly larger and fewer in number. The blastoderm thus formed produces a lighter spot on one side of the egg, which strikingly resembles the primitive cumulus of the Arachnids. With the formation of this blastoderm the secretion of the blastodermhaut (amnion of Packard, deutovum of my former paper[3]) begins.

(3) In from eight to eleven days after impregnation (the period varies in eggs of the same lot) a small circular pit appears in the center of the primitive cumulus. This I regard as the blastopore. This soon becomes triangular and then elongates, while on the next day a second cloud appears behind the first, but connected with it. At first the second cloud is smaller, but it rapidly attainse quality with the primitive cumulus, and soon surpasses it. During this process the outlines become indistinct, more so than in Balfour's[4] Pl. XIX., Fig. 1, which in other respects, except in length, agrees well. During this process the blastopore increases in length backwards, in the shape of a shallow groove (primitive groove), the enlarged anterior end of which continues to mark the original site of the first appearance of the structure. This primitive groove runs back into the posterior cloud and fades out behind. A second lighter area has now become prominent along the margins of the blastopore and its posterior continuation, produced by the proliferation, as shown by sections, of mesodermal cells from the margins. These wander in between the rest of the blastoderm (ectoderm) and the yolk (entoderm) cells which occupy the interior. Gastrulation produces no entoderm.

(4) In fifteen days this primitive groove has become less distinct, through the flattening of its walls; while the germinal area, now outlined by the limits of the extension of the mesoderm, has become divided by the appearance of a transverse groove into cephalic and post-

[2] Zeitschr. f. wiss. Zool., XXI, 1871.

[3] *Quarterly Jour. Micros. Sci.*, XXV., 1885.

[4] *Q. J. M. S.*, XX., 1880.

oral plates, the anterior being smaller and more sharply limited than the other. In twelve hours more a second groove appears behind the first, cutting off a narrow ridge, the first post-oral somite. At this stage the embryo is readily comparable with Metschnikoff's Pl. XVII, Fig. 3, except in the following particulars: The two ends of the embryo are more nearly equal, the single somite developed is much shorter, and the median groove is fainter and extends into both cephalic and caudal plates. Successive somites are added by budding from the caudal plate until the number six is reached. The embryo now closely resembles Balfour's Pl. XIX, Figs. 3*a* and 3*b*, except that it covers far less of the surface of the egg, the first somite is separate from the cephalic plate, the primitive groove extends across the somites, its anterior end terminating at the mouth, while posteriorly it runs into the caudal plate: the caudal plate is much smaller than in Balfour's figure.

(5) Just after six somites are formed, paired thickenings, the rudiments of legs, arise near the outer margins of each. Then six pairs arise simultaneously. I have seen no traces of Osborn's semicircular groove.

(6) Almost simultaneously with the outgrowth of the legs, paired thickenings for the nervous system appear. There are a pair of these in each somite of the body, while three pairs appear in the cephalic plate. A few days later a series of six pairs of segmentally arranged sensory thickenings arise outside of the legs, and extend in a line from the cephalic lobes backwards, as briefly described by Patten.[5] These have different fates. The first pair gives rise to the median ocelli of the adult; the second to a peculiar sense organ as yet undescribed, occurring on the thin skin just in front of the first pair of appendages; the third soon disappeares; the fourth forms the "dorsal organ" of Watase, which persists longer than the third; the fifth gives rise to the paired compound eyes; while the sixth is evanescent. At first these are all similar and are plainly sensory. These organs are connected with each other and with the brain by a longitudinal nerve, which takes an undulating course between the organs and the bases of the legs.

(7) There is a precocious separation of ectoderm and entoderm (yolk cells) during the formation of the blastoderm. Blastopore and primitive groove produce no invagination of entoderm cells. The entoderm retains its primitive character as a solid mass of large yolk cells until after the caudal spine appears. The yolk cells are not true

[5] *Jour. Morphology*, III.

vitellophags. They metabolize the yolk which is contained in each, but the cells themselves are directly converted into the lining epithelium of the mid gut. By this process a lumen is formed, first at the anterior end. The stomodeal-mesenteric wall is first to break through; the opening into the proctodeum appears much later. The proctodeum is very short, not extending far from the anus.

(8) In embryos at the time of hatching the sternal artery has arrived at the condition found in the adult scorpion. It consists of a tube lying on the upper surface of each half of the œsophageal nerve ring. Not until much later than my studies have gone does it attain the investing character of the adult.

(9) Packard's "brick-red gland" is of mesodermal origin. It contains in its interior the cavity of the fifth post-oral somite. Its inner end is terminated by a thin layer of flattened epithelium. It soon becomes folded on itself, and the region of the bend grows rapidly forward. The outer limb of the fold becomes in turn folded at four points, and these new bends grow out in each body segment, giving rise to the lobes characteristic of the organ in the adult. With the folding numerous fusions of the walls occur, followed by perforations, giving rise to the peculiar anastomosing structure of the adult organ.

These points, so briefly summarized, go far, I think, toward the support of that view which would recognize a close relationship between Arachnids and Limulus, while at the same time they serve to remove the Merostomata more widely from the Crustacea.—J. S. Kingsley, *July 17, 1890.*

A Review of Some of the North American Ground Squirrels of the Genus Tamais.—By J. A. Allen.—Bull. Am. Mus. Nat. Hist., Vol. III.—This paper is a revision of the "*Tamais asiaticus*" group of a former monograph of the genus Tamias, made necessary by the accumulation of a variety and quantity of new material during the last five years. It is a valuable contribution to mammalian literature.

The material in hand seems to require the provisional recognition of not less than twenty-four forms, of which thirteen are here for the first time described. These twenty-four forms fall into several more or less well-marked groups, as follows:

1. The *hindsii* group, consisting of (1) *T. hindsii*, (2) *T. townsendii*, (3) *T. macrorhabdotis*, (4) *T. senex*, (5) *T. quadrimaculatus*, (6) *T. merriamii*.

2. The *dorsalis* group, consisting of (1) *T. dorsalis*, (2) *T. obscurus*.

3. The *umbrinus* group, consisting of (1) *T. umbrinus*, (2) *T. cimereicollis*, (3) *T. bulleri*.

4. The *quadrivittatus* group, consisting of (1) *quadrivittatus*, (2) *T. luteiventris*, (3) *T. affinis*, (4) *T. neglectus*, (5) *T. borealis*, (6) possibly also *T. gracilis*.

5. The *minimus* group, consisting of (1) *T. minimus*, (2) *T. consobrinus*, (3) *T. pictus*.

6. The *frater* group, consisting of (1) *T. frater*, (2) *T. amœnus*.

T. speciosus is a rather isolated species, more closely resembling *T. frater* than any other form. *T. asiaticus* has no close affiliation with any of the American forms.

A table of measurements, a "key" giving the salient features of the various forms of Tamias, and a diagram indicating the status, relationships, and lines of probable intergradation, accompany the paper, and make it a complete exposition of the group considered up to date.

PHYSIOLOGY.

Functions of Central Nervous System of Invertebrates.—Steiner[1] endeavors to determine experimentally what ought to be regarded as the the brain of those invertebrates that possess a supra-œsophageal ganglion, œsophageal commissure, and ventral ganglia. He regards the brain as characterized by the presence of the general motor centre in connection with at least one of the nerves of the special senses. In the crustaceans (Astacus, Carcinus, and Maja) removal of one-half of the supra-œsophageal ganglion, or cutting of the œsophageal commissure, caused circular movements toward the uninjured side. This indicates the presence of the general motor centre in the ganglion, and since it also gives origin to the nerves of the higher senses, the author regards it as the brain of the crustaceans. Experiments on insects (Blatta, Blaps, Carabus, Geotrupes, Musca, Vespa, Pieris, Papilio), and on myriapods (Julus), gave similar results. In molluscs (Pterotrachea, Pleurobrachea, Aplysia) destruction of even the whole of the supra-œsophageal ganglion did not affect the movements, but the latter ceased as soon as the pedal ganglion was destroyed. In Octopus, after destruction of the dorsal ganglion, the movements took place normally, but only after stimulation, never spontaneously. This ganglion hence appears to perform the part of a cerebrum instead of a whole brain. Among annelids (Ophelia, Eunice, Diopatra, Nephthys) cutting the œsophageal commissure caused disturbance of movement.

[1] Sitzber d. königl. Preuss. Akad. d. Wissensch. zu Berlin, 1890. II., p. 39. Cf. *Centralb. f. Physiologie*, Bd. IV., p. 180, 1890.

In the author's sense, then, the supra-œsophageal ganglion is a proper brain only in the arthropods; in the molluscs and annelids it is only a sense-centre. In arthropods, especially crustaceans, evidence was obtained of a crossing of the nerve-paths in the sub-œsophageal ganglion, analogous to the decussation of the pyramids in the medulla of vertebrates.

Cerebral Localization.—The well-known statistician, Bertillon, was deaf in his left ear from his tenth year, and was also left-handed. Manouvrier[2] publishes the results of a detailed examination of his brain. The right superior temporal convolution (position of centre of hearing) was narrow, straight, and poorly developed, while that of the other side was broad, winding, and provided with secondary sulci. In accordance with the presence of left-handedness, the speech centre was to be looked for upon the right side; and accordingly Broca's convolution on that side was considerably more developed than upon the left. Bertillon, therefore, "spoke with his deaf hemishere," which must be regarded as an unfavorable relation, and with this must be associated the difficulty of speech from which he suffered in life. The right sight centre was especially strongly developed, which is regarded by the author in the light of a compensation for the poor sense of hearing. The results go far to confirm the localization theories.

ENTOMOLOGY.

The Black Harvest Spider.—In a lot of Phalangiidæ, received from Mr. Lawrence Bruner, and collected at Lincoln, Nebraska, I found a number of specimens of the species described by Say and Wood as *Phalangium nigrum*. Its characters at once place it not only out of the genus in which it is at present retained, but also out of the sub-family *Phalangiinæ*, as it belongs to the *Sclerosomatinæ*, being the first species of this sub-family to be recognized in our fauna. It apparently falls into the genus Astrobunus Thorell, and hence should be known as *Astrobunus nigrum* Say.

The literature of this Harvest Spider is quite limited. Originally described in 1821 by Thomas Say,[1] who reported it as "not uncommon in the Carolinas and Georgia," it received no further mention

[2] *Bull. d. l. Soc. d. Psychologie Physicol.*, 1889. p. 24. Cf. *Centralblatt f. Physiologie*, IV., p. 180, 1890.

[1] Jour. Phila. Acad., VI., pp. 66-67. Compl. Writings, II., p. 14.

until 1868, when Dr. H. C. Wood again described it[2] from specimens collected in Nebraska and Texas. Bibliographical references to it have also since been published by Professor L. M. Underwood[3] and myself.[4]

It is a little strange that this species does not occur in collections of Phalangiidæ from North Carolina and Alabama, kindly sent me by Professor Geo. F. Atkinson. As already noted, Say says it is not uncommon in the Carolinas and Georgia. Dr. Wood says of his Texas and Nebraska specimens: "The form just described has been recognized as *P. nigrum* Say, but as there are some slight disagreements with the description of that authority, and the localities are widely separated, it is possible that it is a distinct species." My specimens are undoubtedly the form described by Wood, and if another species should be discovered in the region mentioned by Say—agreeing with his brief description and differing from the Western form—the latter, of course, would have to be re-named.

This species may be described as follows:

Male (plate).—Body, 6 mm. long; 3.5 mm. wide; Palpi 4 mm. long. Legs, I., 11 mm.; II., 18 mm.; III., 11 mm.; IV., 17 mm.

Black: Ventrum of cephalothorax (including coxæ), trochanters, and base of femora, brown. In some specimens the apical portion of the legs and more or less of the ground color of the dorsum is brownish black. Dorsum thickly studded with small hemispherical black granules or tubercles. Segmentation of abdominal scutum indicated by faint impressed lines. Eye eminence longer than high; not canaliculate; covered with black tubercles like those on the dorsum. Palpi black, except coxal joint, which is brown; all the joints slightly arched; furnished with more or less scattered tubercles and spinose hairs. Mandibles blackish. Legs short, robust, granulate. Ventral surface of abdomen brownish black, granulate. Genital organ "slender, proximally sub-cylindrical, then flattened and slightly expanded, then rapidly expanded into a broad, somewhat circular, very thin, alate portion, then suddenly contracted and bent at an obtuse angle, ending in a very fine point."[5]

Female.—Body, 9 mm. long; 5 mm. wide. Legs, I., 11 mm.; II., 20 mm.; III., 11 mm.; IV., 19 mm. Besides its larger size, it differs from the male in having less black on the ventral surface, which is

[2] Communications Essex Institute, VI., pp. 34-35.

[3] Canadian Entomologist, XVII., p. 168.

[4] Bull. Ill. St. Lab. Nat. Hist., III., p. 105.

[5] Wood, *l. c.*

cinnamon rufous, spotted with black; mandibles brown, black above; and the outer margins of the dorsum smooth, without the black tubercles which form a large, distinct, quadrangular, plate on the middle of the abdomen, and a transverse plate on each of the three posterior segments. The smooth margins are dark brown.

Described from eight males and one female collected at Lincoln, Nebraska. The species is well illustrated, both natural size, and with the parts magnified (at Plate XXIV), the drawings for which have been prepared for my assistant, Miss Freda Detmers.—CLARENCE M. WEED.

EXPLANATION OF PLATE.

FIG. 1. *Astrobunus nigrum* Say, male, natural size.

FIG. 2. Parts of same, magnified: *a*, dorsal surface of body; *b*, eye eminence, side view; *c*, eye eminence, front view; *d*, palpus, side view; *e*, claw of palpus, side view.

The Live Oak Caterpillar.—In a recent number of *Zoe*, a new biological journal published at San Francisco, H. H. Behr adds another insect to the list of those which the English sparrow indirectly protects. He says: "There exists around our bay a moth, *Phryganidia californica*, which lives exclusively on live oak, though I have lately found some stray larvæ on *Quercus lobata*. When, in 1853, I first found the caterpillar of this species I considered it a great prize, so rare was the little thing. Gradually the insect became less rare, and as soon as a sufficient number of shot-guns were placed in the hands of boys who shot little birds, I had ample opportunities to fill the empty spot in my collection that for years had only the male of the species on a pin.

"I have counted four generations of the insect in one summer. Nevertheless they did not endanger the life of the trees inhabited by them. There existed still a sufficient number of insect-feeding birds to decimate the four broods, especially a species of titmouse, then rather common in our surroundings, and very frequent in Marion county, which took care of the eggs and the adult caterpillars. This bird managed in some way to escape destruction by the shot-gun; but then the English sparrow was introduced by some well-meaning but imperfectly instructed people. The sparrow soon drove away the titmouse. The titmouse no more decimated the Phryganidia egg and larva, at both of which the sparrow looked with a contemptuous smile. The Phryganidia multiplied in mathematical progression; the leaves of the live oaks, for instance, at San Rafael, disappeared four times a sum-

mer; some trees survived, other succumbed; and so the introduction of the English sparrow destroyed our California live oaks. The best proof of this is that the destruction coincides with the spreading of the sparrow."

Bibliography of Economic Entomology.—The first three parts of the Bibliography of the More Important Contributions to American Economic Entomology, which has been in preparation by the U. S. Department of Agriculture since 1882, have just been issued. They comprise the writings of B. D. Walsh (Part I.); Walsh and Riley (Part II.), and C. V. Riley (Part III.); there being in the first 385 entries, in the second 479, and in the third 1556. The work has been prepared by Dr. Samuel Henshaw, and bears evidence of having been carefully done. It is accompanied by a very complete index, which will be appreciated by every working entomologist.

Entomological Notes.—The current number of the Transactions of the American Entomological Society (Vol. XVII., No. 1) contains two valuable papers by Dr. G. H. Horn on the North American species of Heterocerus and Octhebius; a similar discussion of the species of Dendroctonus by Dr. W. G. Dietz; descriptions of three new species of North American Odonata, and notes on three others, by Philip H. Calvert; descriptions of a number of new species of Agrotis, by John B. Smith; and a valuable paper by H. F. Bassett on new species of Cynipidæ.

Prof. G. F. Atkinson's excellent paper on Nematode Root-Galls (*Heterodera radicola*) has been republished in the Journal of the Elisha Mitchell Scientific Society (Vol. VI., pp. 81–130).

In the same journal (pp. 134–147), Prof. W. L. Poteat presents some interesting notes on the architectural and feeding habits of a tube-building spider (*Atypus niger* Hentz).

Mr. E. A. Schwarz has published (Proc. Ent. Soc. Washington, Vol. I., pp. 237–247) an important paper on the Myrmecophilous Coleoptera found in temperate North America. A list of the beetles and their hosts is given.

Prof. J. B. Smith has published, as Special Bulletin K, of the New Jersey Experiment Station, an extended report upon the cranberry insects of that State.

Bulletin No. 1 of the Colorado Biological Association contains a valuable paper on the Hymenoptera of Colorado, by William H. Ash-

mead. This is a part of the natural history survey of the State undertaken by the Association, and the paper is based largely upon material furnished by the Secretary, Mr. T. D. A. Cockerell. Three new genera are characterized, viz., Neolaraa, of the family Bembecidæ; Microbracon, of the Braconidæ, and Dolichopselephus, of the Ichneumonidæ. Sixty-seven new species are described, the descriptions of forty-one of which were drawn up from single specimens. The hymenopterous fauna of the State, so far as it is now known, includes 33 families, 247 genera, and 897 species.

ARCHÆOLOGY AND ETHNOLOGY.

On the Use of the Phonograph Among the Zuni Indians.—Ever since I began my work with the phonograph as a means of preserving the language of the American Indians, I have looked forward with great interest to a visit to some of those tribes which still remain in approximately the same condition that they were when first visited by white men. Such tribes it is almost impossible to find now in the confines of the United States. But there are some which have been very little changed.

I have been particularly anxious to make observations among the Pueblo Indians, which still possess many interesting features of great antiquity. Of all the Pueblos, except possibly the Moquis, the Zuñians, or A'sheewee as they are called in their own tongue, have been least changed from their original condition by contact with Europeans. Living at a distance from the railroad, inhabiting isolated regions difficult of access, these people have preserved the ancestral traditions and customs in their primitive form. In many ways they offer an unparallelled opportunity for the study of the religious and secular celebrations of Pueblo Indians, slightly modified from the olden time.

A previous visit to Zuñi, in the summer of 1889, had inspired in me a wish to attempt to record on the cylinders of the phonograph the songs, rituals, and prayers used by these people, especially in those most immutable of all observances, sacred ceremonials. I was particularly anxious to record the songs connected with the celebration of the mid-summer dances, which occur at or near the summer solstice. By the help of Mrs. Hemenway, of Boston, it was possible for me, in the interest of the Hemenway Expedition, to visit Zuñi Pueblo at this time, and I have been fortunate enough to take on the phonograph,

from the lips of the Zuñians, a series of records illustrating the songs used in their sacred and secular observances. An extended paper, with illustrations of the dances, has been prepared for publication, and will be printed as soon as the music can be written out by an expert from the cylinders of the phonograph. Although I prefer not to publish my final contribution until the illustrations are prepared from my photographs, a brief notice of some of the phonographic records which I have may not be without interest.

One of the most interesting of the songs sung at this dance, which is called the Kea' kok' shi or good dance, is that of the Kō kō. This song I took directly from the lips of one of the participants in the dance. I have reason to believe that this song is improvised each year, as the music this summer is quite different from that of a year ago. I was told by the Zuñians before the dance that they did not know what the song was to be, and that no one knew except the participants. There is, however, a general resemblance, yet still great variety, in all these "Kō kō songs," and I have indelibly taken on phonographic cylinders as many as possible for a comparative study at a more favorable opportunity.

The possibility that the songs of the Kō kō were originally imitations of the wind blowing down the fireplace or around the house, is a fascinating idea which hardly seems capable of proof or the contrary. There are often strains in the Kō kō songs that remind one of the wind, and it is right appropriate that such imitations should occur in dances instituted for rain, which is ordinarily associated with the wind. At this place it may be well to mention the fact that there is introduced into the dance an implement to imitate the wind. On the entrance of the Kō kō into the Pueblo, and during the dances, the clowns or other persons, generally the clowns, have a small stick fastened to a buckskin thong, which they whirl about in a circle, making the sound of the wind. This implement, which is the exact counterpart of the "bull roarer," so well known to boys in some English communities, is called the wind. I cannot discover that it is used in the sacred ceremonies to frighten the women and children, or those who do not take part in the dance. Sometimes it is even used as a plaything by the Zuñi boys. In Australia an instrument almost exactly similar is used in sacred ceremonies to frighten those who do not take part, or to let them know that exercises are in progress, for which purpose its use was not unknown among the ancient Greeks.

Four days before the dance, on the afternoon before the departure of a delegation of priests to offer feather plumes at the "Sacred

Lake," Tay jay-po une, a ceremony takes place in the Pueblo, which may be called the "Ducking of the Clowns." This observance is known to the Zuñians as the Dumăchimche, from the words of the song by the Ko ye a mashi, or mudhead clowns, on whom, in the course of the celebration, water is poured from the housetops by the squaws. This song has internal evidence of antiquity, and I am told by the Indians that both song and ceremony is very ancient. Although a musical critic might not find in it great beauty, as an undoubted specimen of ancient aboriginal music it is very interesting. I shall comment on the meaning of the Dumăchimche in another place, when the ceremony will be described at length.

A survival of the old practice of communal hunting still exists in some of the Pueblos in the so-called rabbit hunt. Several of these hunts have taken place during my residence in Zuñi. It has seemed to me that it is a semi-religious observance connected with summer dances, and I have therefore taken records of the song and prayer used by the hunters for future study.

While my observations have been particularly directed to the linguistic features of the solstitial dances in summer, I have not wholly neglected the great wealth of other material all about me for linguistic study by means of the phonograph.

The well-known celebration called the Sha' la 'ko, at which the Zuñi house is consecrated, is the occasion of an elaborate ceremonial, in which figures a song or chant and a prayer, said to be very ancient. I have never witnessed the celebration of the Sha' la 'ko, but have been able to obtain the chant and prayer from one of the natives. This capture had to be made secretly, unknown to the other Indians. It was found necessary to take it late at night, in a room darkened with blankets at the windows to prevent suspicion, and sentinels stationed about the house to warn us of the approach of intruders. On those conditions only was it possible to get the Indian to chant the Sa' hla 'ko on the phonograph. It is now, however, permanently recorded in the wax, and can be reproduced at pleasure, or what is of more importance to philological study, can be written out and studied at leisure under better conditions. I am told that it is next to impossible to get any of the Zuñians to sing the Sha' la 'ko out of season, and as the celebration regularly comes in November, a record of it in July is a fortunate acquisition. Certain of their winter songs they will not sing in summer, because to do it prevents the corn from growing. I do not know whether or not the chant of the Sha' la 'ko is one of these.

The phonographic record to which I look forward with the greatest hope is that of a Zuñi ritual to which writers have from time to time referred. This ritual, which has been designated by the dignified title of a Zuñi Epic, is of considerable length, and is regarded with great reference by the Zuñi people themselves. Haluta, the reciter of it at the time of its delivery, is said to be regarded as a most sacred personage, and when, prior to its recital, he is brought into the Pueblo his feet, it is said, are not allowed to touch the ground. It is thought probable that a phonographic record of the ritual would be an addition to our knowledge of Zuñian mythology.

The extracts from this ritual, which are freely translated from memory* by Mr. Cushing in his interesting paper on Zuñi Fetishes, indicate that it is a valuable account of the mythological history of the race. He had not at his command an instrument to record the words of those portions of the "Kaklan" which he heard, and consequently was unable to give it in the original diction in which it is given before the members of certain priesthoods, to whom alone it is recited. He says that many of the words are in old Zuñi, not understood at present. The records which I have are good enough to enable me to write out the ritual, which, however, at the present state of my knowledge of the language I am unable to translate. With the help of those who understand the language, as well as English, I have no fear but that in my final paper I can publish a translation of the ritual as told by Haluta on the cylinder of the phonograph.

I have, after several failures, been able to get this recital on the phonograph, where it fills a long series of cylinders. Before the value of this record, both linguistic and mythological, can be appreciated, it must be carefully written out and studied. This will take a long time, as many of the words are old Zuñian, and the task of extracting the meaning from the ritual will found to be a difficult one. A permanent preservation of it is, however, a step in the interpretation, and when once indelibly fixed on phonographic cylinders its true character and significance can be investigated.

One of the most interesting of the Zuñi songs is that of the hunters. This song has many beautiful parts in it, and outside of its interest in the study of the customs of the hunters, is well worth preserving as a specimen of aboriginal music. I have thought it worthy of a place in my collection, and with it I have also preserved certain of the prayers to the fetishes used in the hunt, some of which have been written out and translated by Mr. Cushing. The harvest which a study of the hunting customs of the Zuñians offers is great, and the collection of

data bearing on this subject is highly important, since the decrease in game may on as New Mexico is more and more thickly settled, and the hunting ceremonials be more or less modified as time goes on.

I have not encountered in my experience in taking records with the phonograph any very great difficulty among the Zuñians. Their real impressions of the instrument it is very difficult to divine. One of them asked if a person was hidden in the machine, and another thought the phonograph bewitched. Indians are so stolid that it is very difficult to discover what impression such a novel instrument as the phonograph really makes. They are so accustomed to incomprehensible machines used by Americans that this last triumph of inventive genius affects them no more than many others which might be mentioned. Certainly they are not afraid of it, and there is no difficulty in getting them to talk into the instrument. The great difficulty in getting them to repeat their sacred songs and prayers does not come so much from their fear of the instrument as of secularizing what is sacred to them. They will readily respond with any of their secular songs, or with those sung in public, but those belonging to the secret ceremonials of the Estufa they will not divulge.—J. WALTER FEWKES, *Zuni, New Mexico, July 5th, 1890.*

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington.—May 31.—The following communications were read: Characteristics of the Halosauroids or Lyopomes; Dr. Theo. Gill. Exhibition of Specimens of New Species of North American Mammals; Dr. C. Hart Merriam. *Coultorella* a New Genus of *Compositæ;* Dr. J. N. Rose. Organisms in the St. Peter's Sandstone; Prof. Joseph F. James.—FREDERIC A. LUCAS, *Secretary.*

Natural Science Association of Staten Island.—May 8, 1890.—The following paper by Mr. Chas. W. Long was read: Staten Island Fire Flies.—No one will have failed to notice the abundance on Staten Island of the beetle commonly known as the firefly. As it is seen in early summer, in the words of Longfellow:

> "Flitting through the dusk of evening,
> With the twinkle of its candle,
> Lighting up the brakes and bushes,"

it constitutes one of the peculiar charms of our latitude. It has been described by many a poet as well as naturalist, and those who have

watched it through a warm June night will not wonder that the naturalist, like Mr. Silas Wegg, may be tempted to "drop into werse." No prose can perfectly represent the mazy evolutions of its flight, but the following from the pen of Mr. Philip Gosse will be found the most accurate: "They fly slowly, and as they fly, emit and conceal their light at intervals of two or three seconds; making interrupted lines of light through the air, gleaming slowly along for about a yard, then suddenly quenched, and appearing again at the same distance ahead." He, like Longfellow, compares the light to candles in the woods. Indeed he says though told what they were, at every one that appeared, the same idea would come across his mind, but the comparison is not so apt with us, for we rarely see them singly, and it rather seems as if they were stars moving through the bushes, or twinkling in some deep valley as we look into it from the hills above. They resemble the stars, too, in the thought of infinite number they suggest. It would be a hopeless task to count the number one can see in a single summer night. And considering the countless summer nights that have elapsed since the first firefly appeared on the globe (fossil Lampyridæ are found in Miocene rocks) the total of all the motions that they have made since then may well suggest a number approaching to mathematical infinity.

Apart from their beauty, our fireflies possess a great interest from the entomologist's point of view, for we find in them some characters specialized to an extraordinary extent. It is unfortunate that among the nine or ten species represented on Staten Island, of which I append a descriptive list, the special sexual characters are not developed as fully as in the Southern species and in the English "glow worm." In the latter, the light organs of the female reach their highest point and she is destitute of wings, while the male possesses normal wing power and very large eyes; clearly indicating the relation of the characters to the reproduction of the species. The light organs of the male are feeble, being useless as an attraction to the female, able only to crawl slowly in the grass. The same characters are found in some of our Texan species, but the only approach to it among the Staten Island species is in *Photinus scintillans*, our most abundant "firefly," of which the female is wingless. The eyes, however, and the light organs are equally developed in each sex.

The antennæ also present some curious forms, none more so than those of *Phengodes plumosa*, a southern species whose occurence on Staten Island was discovered by Mr. W. T. Davis, to whom I am indebted for my specimen. Here the antennæ consist as usual of

eleven linear joints, from each of which proceed two branches, as long as the entire antennæ, curved and fringed both sides with long hair. The branches become shorter toward the outer extremity, and the effect is very similar to a white ostrich plume. The females of this and all the species of Phengodes are unknown. Beyond these characters, the fireflies resemble the general coleopterous form. It is not difficult to catch and examine one, for they frequently rest on a stalk of grass, continuing to give out the intermittent yellow gleam, thus guiding one to the spot. In the hand the insect will be found to consist, seen from above, of the thorax in front, a semicircular piece ornamented with rosy patches and a black spot, and two "elytra," parallel yellowish pieces, comprising the greater part of the dorsal aspect. Beneath will be found the head, concealed from above by the hood-like thorax, with biting jaws; the six legs possessed by all beetles; and the abdomen, divided into segments, from the last three proceeding the light which gives the family its name and renown. The light may be watched, throbbing and pulsating, as the small creature silently tells that it, like its captor, lives and breathes. If it be crushed, the light still continues for a time, but gradually dies away. In the dried specimens these segments are cream colored. The physical cause of the luminosity in fireflies is unknown. Dr. Leconte cites some partially successful experiments to isolate the actual luminous substance by Dr. T. L. Phipson and others, and the name "Noctilucine" has been applied to it, and its existence stated in varied forms of marine life, in Myriapoda and in putrid fish, but I am not aware that positive results have been reached.

The larvæ of these insects are also somewhat luminous, and are found in the grass in summer. They are carnivorous, and are to be reckoned among the beneficial insects.

The description of the firefly is taken particularly from the species common in gardens, and the flight of that insect (*P. scintillans*) is also described, and as Mr. Davis has mentioned to me that the larger species have a more rapid flight, it is proper to so state here to guard against error.

This list of our species includes all known to me from the neighborhood of New York, and Phengodes is new to the fauna of the vicinity. Being the result of the observations of two persons only, it would be hazardous to represent it as complete, particularly in view of the warm and sandy character of the southern end of the island, where we may hope to find additions to our list. They may be sought by jarring the leaves and branches of shrubbery where they remain during the day.

LIST OF THE SPECIES OF SUB-FAMILY LAMPYRIDÆ.

Head more or less covered by the hood-like thorax; antennæ not plumose:
- Head completely covered; 2d joint of antennæ small; transverse;
  - Antennal joints very broadly compressed; color black; sides and apical margin of thorax fulvous, .28-.44 ins. 1. *Lucidota atra.*
  - Antennal joints not broadly compressed;
    - Eyes small; color black; thorax fulvous, with disk and sides black; last dorsal segment in male rounded, .28-.54 ins. 2. *Ellychnia corrusca.*
    - Eyes small; last dorsal segment in male bisinuate and truncate;
      - Prothorax with black disk and reddish yellow sides, .25 ins. 3. *Pyropyga nigricans.*
      - Prothorax with black disk and edge, .25 ins. 4. *Pyropyga decipiens.*
    - Eyes large; prothorax subcarinate; elytra with wide side margin;
      - Elytra black, margin and suture yellow; thorax like No. 2, .30-.50 ins. 5. *Pyractomena angulata.*
    - Eyes large; prothorax not carinate; elytra without wide margin;
      - Larger species; female elytra long like male, .36-.52 ins. 6. *Photinus pyralis.*
      - Smaller species; female wingless, elytra short, .22-.32 ins. 7. *Photinus scintillans.*
- Head only partially covered; 2d joint of antennæ not transverse, as long as 3d.
  - Color dull yellow; prothorax red on disk, with a dark medial stripe, elytra dull yellow, more or less striped with black, .42-.60 ins. 8. *Photuris pennsylvanica.*

Head exposed; antennæ plumose;
- Elytra subulate, color testaceous, .50 ins. 9. *Phengodes plumosa.*

The length of the insect in 100ths of an inch is indicated before the name. The species numbered 4 and 5 are northern insects and rare with us, and No. 9 is, as stated above, a southern species. The light organs are more feeble in 1 to 5, and more strongly developed in 6 to 8, which are the common "fireflies."

A preliminary list of the mosses of Staten Island, compiled by Mrs. N. L. Britton, was presented, which will be published as an extra.

Mr. Arthur Hollick showed dried specimens of *Clematis ochroleuca*, collected during the past month at Richmond, which is a new locality for this interesting plant, or perhaps only an extension of the previously known localities on Todt Hill and at Egbertville. It was in great abundance, accompanied, as usual, by *Cerastium arvense*, var. *oblongifolium* in dense clusters, particularly where the serpentine had been exposed. Mr. Hollick also showed staminate catkins of *Salix fragilis*, from a tree in Richmond, which were bi- and tri-furcated. This peculiar state of the catkins of this willow was noted some years since on a tree at Prince's Bay (See *Bull. Torr. Bot. Club*, VI., 312), and it is not unlikely that it may be looked for in other places.

Mr. L. P. Gratacap presented a block of Potsdam sandstone, beautifully ripple-marked, from the drift at the base of the bluff on the shore at Tottenville. Also clay ironstone containing plant remains and nodules of pyrite from the same locality, and lignite from the clay beds near Kreischerville.

Mr. Ira K. Morris read a paper upon "Some Old Staten Island Springs."

American Association for the Advancement of Science, 1889.—REPORT OF THE COMMITTEE ON ANATOMICAL NOMENCLATURE, WITH SPECIAL REFERENCE TO THE BRAIN.—During the past year some of the members of the Committee have given to the subject intrusted to them as much time as their regular duties would permit. They agree upon one point, viz., the advantages, other things being equal, of *mononyms* (single word terms) over polynyms (terms consisting of two or more words). Before making specific recommendations or presenting a final report, the Committee think it advisable that they and other anatomists should have an opportunity of discussing at leisure the simplified nomenclature which they are informed is employed in certain treatises which will be published during the coming winter. They therefore ask to be continued.

BURT G. WILDER, *Chairman.*
HARRISON ALLEN,
FRANK BAKER,
HENRY F. OSBORN,
T. B. STOWELL,
Committee.

The Association of American Anatomists.—PRELIMINARY REPORT OF THE COMMITTEE ON ANATOMICAL NOMENCLATURE, ADOPTED DECEMBER 28, 1889, BY THE ASSOCIATION.—The Committee recommend:

1. That the adjectives *dorsal* and *ventral* be employed in place of *posterior* and *anterior* as commonly used in human anatomy, and in place of *upper* and *lower* as sometimes used in comparative anatomy.

2. That the cornua of the spinal cord, and the spinal nerve-roots, be designated as *dorsal* and *ventral* rather than as *posterior* and *anterior*.

3. That the costiferous vertebræ be called *thoracic* rather than *dorsal*.

4. That the *hippocampus minor* be called *calcar*; the *hippocampus major*, *hippocampus*; the *pons Varolii*, *pons*; the *insula Reilii*, *insula*; *pia mater* and *dura mater*, respectively *pia* and *dura*."

Signed by all the members.
JOSEPH LEIDY, *Chairman*.
HARRISON ALLEN,
FRANK BAKER,
THOMAS B. STOWELL,
BURT G. WILDER.

Thomas Dwight was added to the committee.

The Committee desire frank and full expressions of opinion from scientific and medical journals, from individuals who receive copies, and from any others who are interested in the subject.

BURT G. WILDER, *Sec'y*.

SCIENTIFIC NEWS.

The Alvarenga Prize, of the College of Physicians of Philadelphia, consisting of one year's income of the bequest of the Señor Alvarenga, of Lisbon, has been awarded to Dr. R. W. Philip, of the Victoria Dispensary for Consumption and Diseases of the Chest, Edinburgh, for his Essay on Pulmonary Tuberculosis, which will be published by the College.

Entomological Club, A. A. A. S.—The Entomological Club of the A. A. A. S. will meet at Indianapolis, August 20, at 9 A. M. There should be a large attendance of entomologists at this meeting, especially of those in the West. The officers are: Professor A. J. Cook, President, and F. M. Webster, Secretary, and both are doing all in their power to make the meeting a success. Professor Cook writes: "Please urge a large attendance from both Canada and the United States. All are invited to be present, and to bring or send papers."

PLATE XXIV.

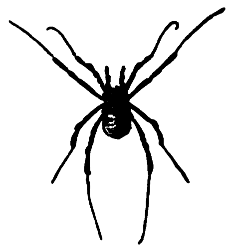


Fig. 1

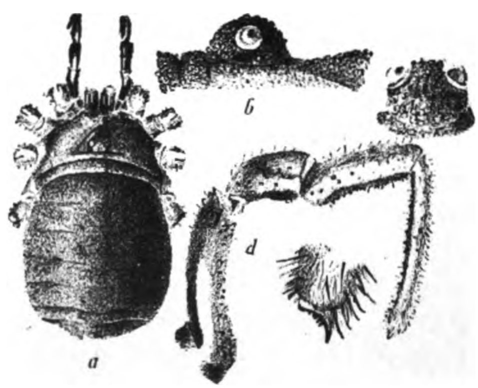


Fig. 2.

Astrobunus nigrum (Say).

THE

AMERICAN NATURALIST

VOL. XXIV. AUGUST, 1890. 284.

THE EXTINCT SIRENIA.

BY E. D. COPE.

THE Sirenia occupy an especial place in the mammalian economy, which is only shared by the seals. They are denizens of the coasts of the sea and its branches, and of the larger rivers. Their present distribution differs from that of the seals in that it especially includes the tropics, where seals are rare; and excludes the polar regions, where seals abound. Extinct forms occur, however, in all the northern temperate regions that have been explored, and there is no reason to doubt that the order was of world-wide distribution during the early and middle parts of Cænozoic time.

The derivation of the Sirenia is shrouded in mystery. They have evidently diverged from land mammals of primitive placental type, and have become specialized in accordance with their peculiar modes of life, and have in many respects degenerated. Rudiments of pelvis and posterior limbs are present in most of them, and they are especially large in some species of the extinct genus Halitherium. Part of such a pelvis from South Carolina is represented in Plate XXV, Fig. 6. The dentition has become more and more reduced, till the enamel layer is lost in Halicore, and the teeth have all disappeared in Rhytina. The least generalized form is Prorastomus Owen, of which remains of a single species (*P. sirenoides*) have been found in the late Cænozoic beds of certain islands of the West Indies. Here the dentition is stated by Lydekker to be: I. $\frac{3}{3}$; C. $\frac{1}{1}$; M. $\frac{8}{8}$?.

The families of this order are the following:

Incisors present in normal number; canines present; molars numerous, rooted, and enamel-covered; *Prorastomidæ.*

Incisors, in less than normal number; no canines; molars in normal number, rooted, and enamel-covered; *Halitheriidæ.*

No incisors; molars present, covered with enamel, and in increased number; *Manatidæ.*

Incisors present; molars prismatic, without enamel, and in reduced number; *Halicoridæ.*

Teeth none; *Rhytinidæ.*

The PRORASTOMIDÆ includes but the one genus, Prorastomus Owen, and this the single species *P. sirenoides* Owen. This is a highly interesting form, having a dentition intermediate between that characteristic of other members of the order and the typical mammalian formula. This is especially true in the normally constituted incisor and canine teeth. The molars are, like those of the manatees, cross-crested grinders, and in larger number than that normal to mammalia generally. The single species has been found in beds of uncertain but probably Eocene age in the West Indian Island of Jamaica.

The greater number of extinct Sirenia belong to the HALITHERIIDÆ, and they occur alike in the old world and in the new. The genera are as follows:

Incisors $\frac{2}{?}$; molars ?; *Dioplotherium* Cope.

Incisors $\frac{1}{1}$; molars 6 or 7, the last superior the most complex; symphysis decurved, compressed; *Halitherium* Kaup.

Incisors $\frac{1}{1}$; premolars, 3; molars, 4, the last superior reduced, simple; *Miosiren* Dollo.

Incisors $\frac{?}{1}$; molars ?; symphysis long, not decurved, cylindric; *Anoplonassa* Cope.

The incisors in the first three genera are tusk-like; in the last they are in the lower jaw, with short root, and are easily shed. Six or seven species of Halitherium are known from the Miocene and Pliocene beds of Western and Southern Europe. The

H. schinzii Kaup from the lower Miocene of Germany (Fig. 1*a*) is about as large as the manatee, while the *H. forrestii* Capellini is much larger, and is from the lower Pliocene of Italy. The *Miosiren kockii* Dollo is known from a skeleton from the Miocene of Belgium. It was rather larger than the manatee, and was nearest to the Halitheria. The principal difference is seen in

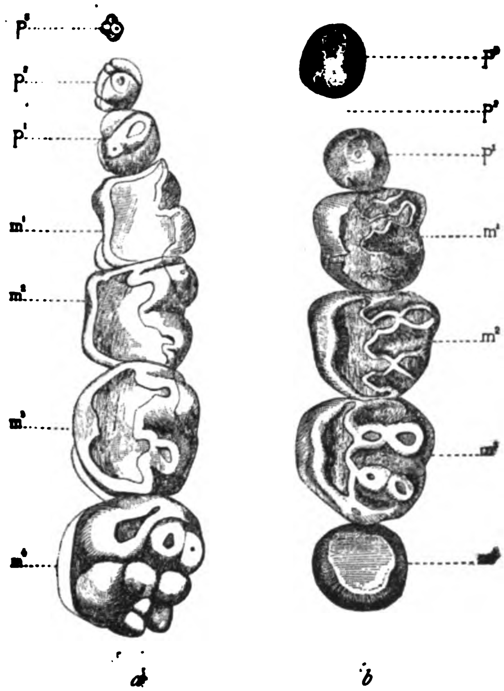


FIG. 1.—Dentition of Halitheriidæ, two-thirds natural size, from Dollo. Fig. *a* *Halitherium schinzii*; *b*, *Miosiren kockii*.

the reduced last superior molar tooth, which shows indications of the reduction in number which took place in the dugong (Fig. 1*b*). The largest species supposed to belong to the family is the *Hemicaulodon effodens* Cope, from New Jersey, which is known from a large superior tooth only. The dentine of this tooth has regular transverse ridges, which are also traceable in a Halitherium (*H. capgrandi* Lart.), and it is covered by a layer of cementum. As the molar teeth are unknown, the reference of this animal to this family remains uncertain. The most primi-

tive form of the Halitheriidæ known is the genus Dioplotherium Cope, with two superior incisors. *D. manigaultii* is a large species which was found near Charleston, S. Carolina, by Dr. G. Manigault of that place (Plate XXV). The first incisor lacks the distal expansion of that of Halitherium. The molars are unknown.

Another and still more remarkable form has been discovered in the phosphatic deposits of South Carolina. This is the genus Anoplonassa Cope, in which the symphysis of one of the jaws is much elongated, is semi-cylindrical, and is not decurved as in the other members of the family. The premolar and molar teeth are shed at maturity, leaving indistinct traces, except, perhaps, the anterior incisor, which is represented by a large, shallow alveolus, and is perhaps not shed (Fig. 2). The muzzle is adapted to

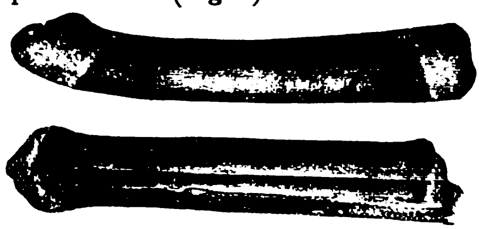
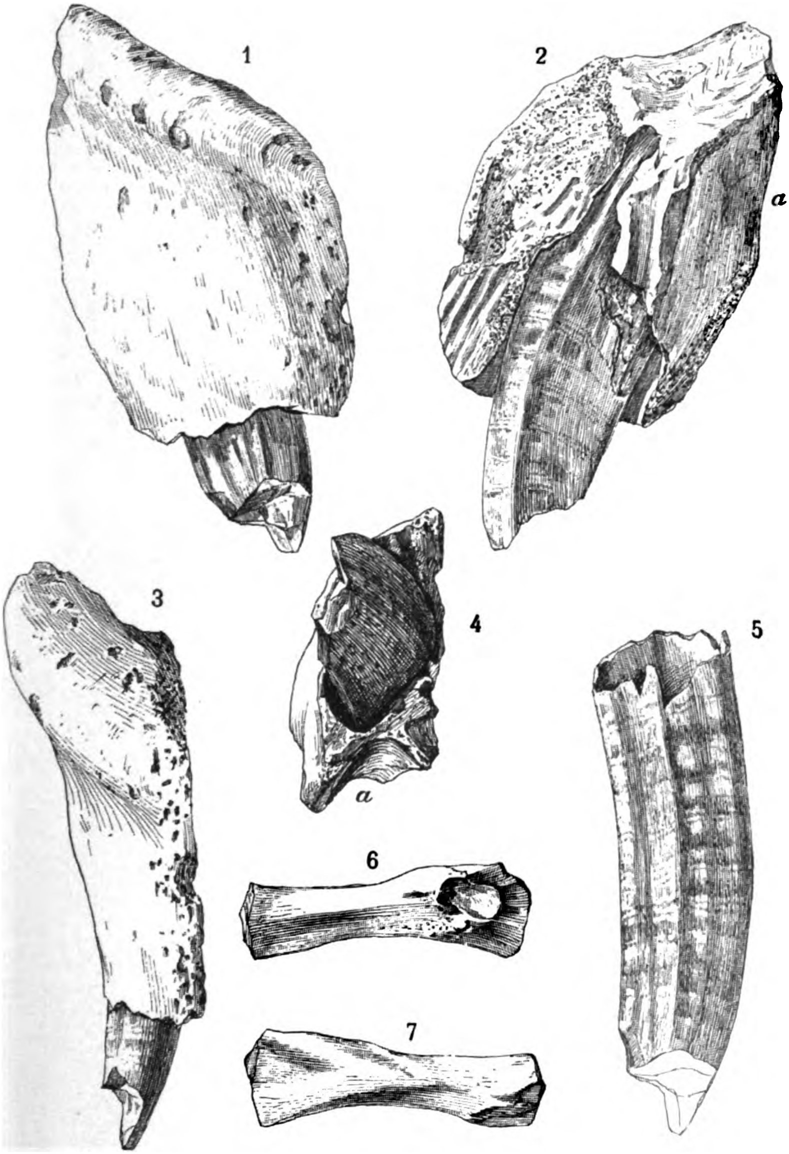


FIG. 2.—*Anoplonassa forcipata* Cope; one-fourth natural size. Original; from South Carolina.

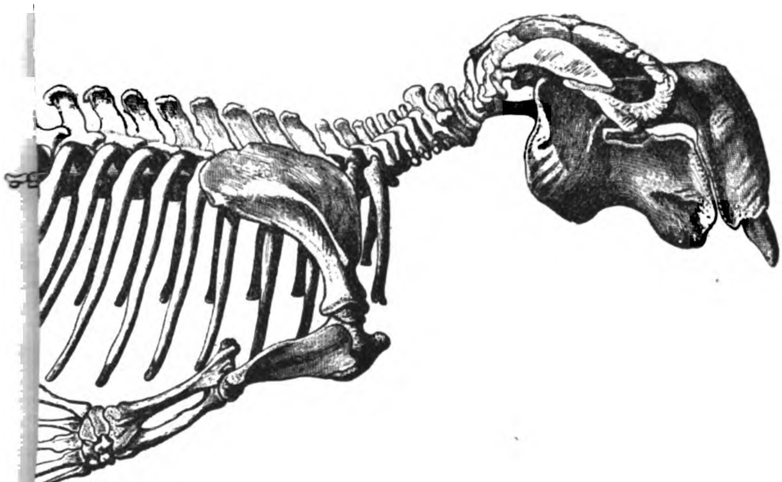
being inserted deep into mud in order to draw thence mollusca or other kinds of food. But one species is known, the *Anoplonassa forcipata* Cope. It is by no means certain that it belongs here, and it may be a Cetacean.

The MANATIDÆ are remarkable for the number of their molars. In the genus Manatus there are eight in the permanent dentition, and a ninth anterior tooth, which is early shed. These molars are all alike, and with two transverse crests in the upper jaw and three in the lower. There is a minute incisor in the upper jaw, which is shed early. Besides the three living species of Manatus but few extinct species are known. Teeth resembling those of the Floridan species have been found in the Charleston deposits, and have been named by Leidy *M. fossilis*, A form from the Eocene of Egypt has been named by Owen *Eotherium egyptiacum*. Filhol does not distinguish the molars from those of Manatus as to their structure, but their number is unknown.

PLATE XXV.



Dioplotherium manigaultii Cope.



Fossil HALICORIDÆ are unknown, except some bones of very

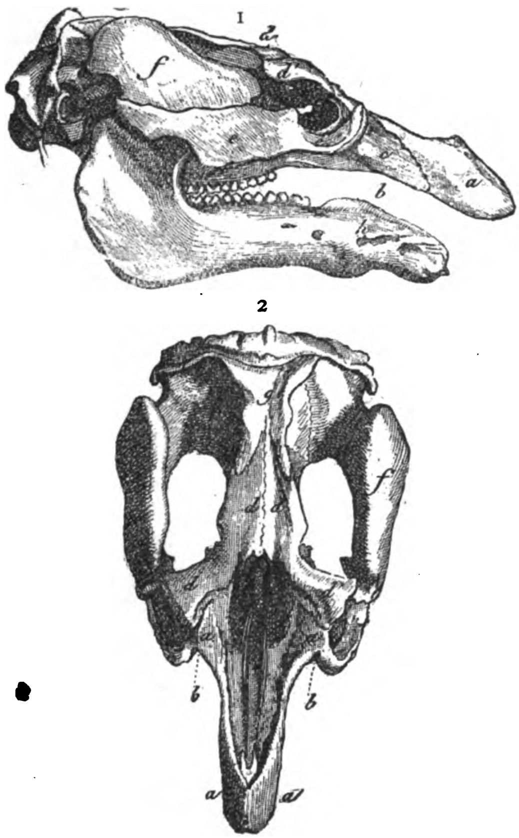
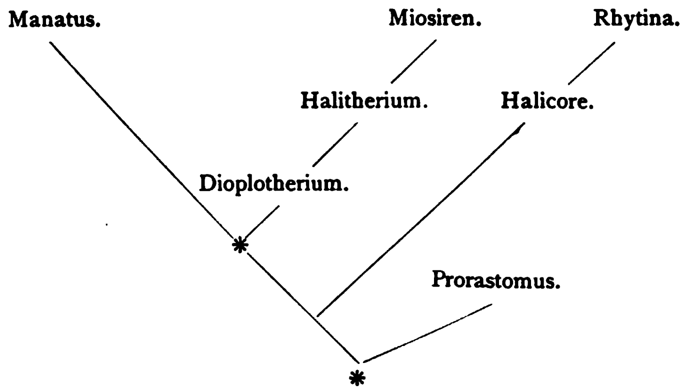


FIG. 3.—***Manatus americanus*** **Cuv.; skull one-twelfth natural size; from Cuvier. 1, ight side; 2, from above. *a*, Premaxillary bone; *b*, foramen infrantitole; *c*, maxillary; *d*, frontal; *e*, molar; *f*, zygomatic process of temporal; *g*, parietal.**

late Tertiary age found in Australia. In the existing genus the dental formula is I. $\frac{1}{0}$; C. $\frac{0}{0}$; M. $\frac{2}{2}$, and the molars are prismatic and of cylindric or oval section, as in some Edentata. (Plate XXVI.) The RHYTINIDÆ are represented thus far by the typical genus and species only, the *R. gigas* Zimm., which dwelt on the coasts of Behring Sea up to a late period of human history. It is one of the large species of mammalia exterminated by man, and its bones are found in considerable abundance on Behring's Island, Commander's Island, etc. Nearly complete skeletons are

preserved in the Museums of St. Petersburg, London, and Washington.

The lines of descent of the Sirenia may be expressed as follows:



EXPLANATION OF PLATES.

PLATE XXV.—*Dioplotherium manigaultii* Cope. Three-eighths natural size. Figs. 1–4, part of premaxillary bone with incisor alveoli, and I. 1 in place; 1 outside; 2 inside; 3 front; 4 from below; *a* alveolus of external incisor. Original; from type in Museum of Charleston, S. C. Figs. 6–7, os innominatum of unknown Sirenian, from Charleston. Reduced.

PLATE XXVI.—*Halicore dugong* Cuv. Skeleton, from Cuvier.

THE CONCRESCENCE THEORY OF THE VERTEBRATE EMBRYO.

BY CHARLES-SEDGWICK MINOT.

(Continued from page 629.)

Blastodermic Vesicle with Two Layers.—Of this stage we have several descriptions; for the rabbit by Kölliker (Grundriss, p. 89), Hensen, *24*, C. Rabl, *44*, 141, as well as the older accounts by Bischoff, *6*, and Coste, *14*, and the brief mention by Heape in Foster and Balfour's Embryology, 2d edition, 316–320; for the mole by Heape, *23*; for the dog by Bischoff, *7*; for the cat by Schäfer, *52*; for the sheep by Bonnet, *10*; and for several rodents as indicated in the section on inversion of the germ layers, p. 711.

The two-layered stage is found in the rabbit about seven, in the sheep about thirteen days after coitus. The dimensions for the sheep are about 4 mm. for the greatest diameter and 2–3 mm. for the lesser diameter.

The two layers form each a closed sack; the embryonic shield is well marked as a round spot less translucent than the walls elsewhere. The outer layer has everywhere a distinctly epithelial character; in the region of the shield its cells are columnar with spherical nuclei; in the rabbit the cells are low, and the nuclei lie nearly at one level (for a good figure see Heape, *23*, Pl. XXI, Fig. 49); in the sheep the cells are taller, and the nuclei are at various levels; in the mole and in various rodents there are several layers apparently, but perhaps in them also the epithelium is columnar, as it certainly is later; at the edge of the shield there is an abrupt change to a very thin layer, with widely expanded cells; consequently in the region of the shield the nuclei are close set, while outside the shield they are wider apart. The change at the edge of the shield is at first less abrupt, but at the present stage is very marked. A similar difference exists in the inner layer: although its cells are very much thinned out everywhere, yet the layer is slightly thicker in the region of the shield; the nuclei of the inner layer are everywhere somewhat flattened, and they are larger and farther apart than the nuclei of the outer layer, a difference which is very obvious in surface views, both during this and the next following stages. The inner layer has an epithelial character in the region of the shield, but further away the cells move apart, and being connected by processes resemble embryonic connective tissue (Bonnet, *10*, 192; Hensen, *24*, Figs. 15 and 11B on Taf. VII; E. Van Beneden, *2*). The relations are illustrated by the accompanying Fig. 17, representing the shield in the sheep at thirteen days, and of a vesicle measuring 4 mm. by 2 mm.; at the left of the figure the layers are folded back over the shield.

The next changes which occur are principally those of growth, both of the vesicle as a whole and of the embryonic shield, which also begins to arch up; the vesicle and shield both become oval; usually the oval shield lies lengthwise, but in the deer, as

shown by Bischoff, it lies transversely of the vesicle. The size of the shield is quite nearly uniform among the placented mammals in which it has been studied, but the size of the vesicle varies extremely; especially noteworthy is the excessively rapid elonga-

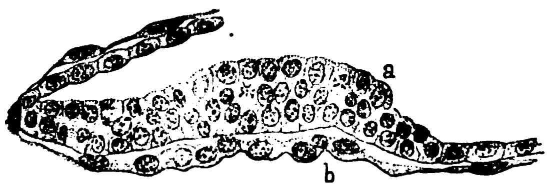


FIG. 17.—Transverse section of the embryonic shield of the blastodermic vesicle of a sheep, thirteen days pregnant, after Bonnet. *a*, outer layer of shield; *b*, inner layer of shield.

tion in ungulates (pig, sheep, goat, and deer); in the sheep, for example, it trebles or sextuples its length in less than a single day after the shield appears. The next step is the appearance of a middle layer, at least in sheep (Bonnet, *10*, 192–196, *11*, 42), which shows in the fresh specimen as a slight turbidity of the vesicular walls just outside the edge of the shield, while in the region of the shield there is no middle layer whatever. Sections show that the new layer consists of loosely scattered cells connected by anastomosing processes. It is everywhere absolutely distinct from the outer layer, but merges at many points with the inner layer. From this connection Bonnet concludes that the middle layer is derived from the inner layer by what must be called a process of delamination. So far as known to me, nothing analogous to this middle layer has yet been observed other mammals. The next important step, again according to Bonnet, *10*, 195, is the appearance of Hensen's knot, which takes place while the peripheral middle layer is developing. The knot is at first a small thickening on the under side of the outer layer; it is situated on the middle line of the shield, a little nearer one end than the other. It is distinctly separated from the inner layer, but is connected with the cells of the middle layer, which have now developed themselves in the middle region of the shield also. Bonnet maintains that the knot gives off cells which contribute to the formation of the middle layer. The knot marks the front end of the future primitive streak.

The appearances in a sheep's ovum at this stage are illustrated by Fig. 18 of a vesicle of 12–13 days from a sheep; the vesicle measured 55 mm. in length by about 1.5 in breadth, but the length of the vesicle is extremely variable at this stage; the specimen had been stained to bring out the small close-set nuclei of the outer layer, and the larger, more widely-set nuclei of the inner. layer. The upwards-arching embryonic shield, *Sh*, shows Hensen's knot, *kn*, and the beginning primitive streak, around the edge of the shield the middle layer makes an irregular shadow, *mes*.

A condition of the blastodermic vesicle similar to that described is figured by Coste for the rabbit, by Bischoff for the rabbit *6*, Taf. IX., Fig. 42, C,—for the dog, *7*, Taf. III., Fig. 28, B; and the gradual extension of the second layer is recorded for the mole by Heape, *23*. Since it is known to occur in rodents, carnivora, and insectivora, it is probably true of all placental mammals that the one-layered vesicle becomes two-layered by the outgrowth of cells for the "inner mass" found at the close of segmentation; this is the first step of development after segmentation.

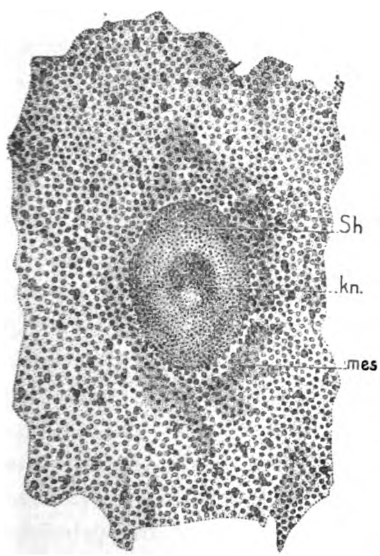


FIG. 18.—Central portion of a sheep's blastodermic vesicle of 12-13 days. *Sh*, shield; *kn*, Hensen's knot; *mes*, "Mesoblasthof"; after Bonnet, 34 diams.

Rauber's Deckschicht has evidently great importance. It was first described by him in the rabbit, *45*; and was also discovered by E. Van Beneden, *1*, who, however, made the blunder of considering it as the permanent ectoderm, and the true ectoderm below it as the mesoderm; this error has been amply corrected by Kölliker, and is now admitted by Van Beneden (see Van Beneden and Julin, *4*). Its disappearance in the rabbit has also been studied by Lieberkühn, *41*. Balfour (Comp. Embryol, II., 219), from investigations on the rabbit by himself and Heape, concluded that the cells of the deck-

schicht disappear by being incorporated in the true ectodermal layer, becoming at the same time columnar; this view is verified by Lieberkühn, *42*, 400–401. As already stated, the rodent modification of the deckschicht is discussed below, page 711. In the rabbit the deckschicht disappears before the second layer of cells grows completely round the vesicle.

Blastodermic Vesicles with Primitive Streak.—The knot of Hensen becomes the front end of the primitive streak, which lengthens backward; during the same period the vesicle as a whole enlarges; in ruminants the enlargement is enormous and very rapid.[1] The primitive streak always lies in the long axis of the shield. The formation of the primitive streak begins with the union of Hensen's knot with the inner layer, so that at the knot all three layers are actually united,—the condition originally discovered by Hensen, *24*, 268. The union of the knot with the inner layer spreads backward along the line which is to become the primitive streak; soon the axial growth reaches the edge of the shield, and the streak and shield elongate together, the latter becoming pointed at its hinder end. We thus have a pear-shaped shield, with the primitive streak running forward from its pointed end; the anterior end of the primitive streak is somewhat enlarged, and the posterior end is considerably thickened; the three layers are united along the primitive streak. Figure 19 represents the embryonic shield of a rabbit embryo; the shield measured 1.34 mm. in length, and 0.85 mm. in width; the primitive streak is a broad band, corresponding to the axial thickening, and extends about two-thirds of the length of the shield; the middle layer, *m′*, *m″*, occupies a circular area around the hind end of the streak;

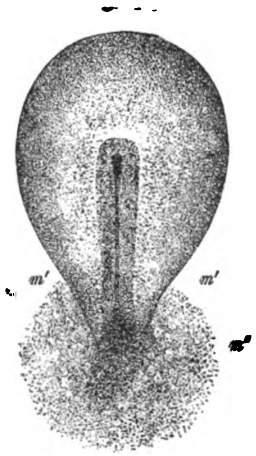


FIG. 19.—Embryonic shield of a rabbit's ovum of five days, to show the primitive streak and the distribution of middle layer, *m′*, *m″*; after Kölliker. 28 diams.

[1] Bonnet states that in the sheep the blastodermic vesicles must elongate during this period at the rate of one centimetre an hour.

for a similar stage in the opossum see Selenka, *57*, Taf. XVIII., Fig. 6; in the mole, Heape, *23*, Pl. XXVIII., Fig. 12; in the sheep, Bonnet, *10*, Taf. x., Figs. 39, 40. Cross sections show: the concrescence of the three layers in the axis; the greater width of the streak in front (to this wide anterior end of the streak the term Hensen's knot continues to be applied); and show also the increasing thickness of the streak posteriorly. The primitive groove, which is a shallow depression of the outer layer, appears first over Hensen's knot, and thence extends gradually backward along the median line of the primitive streak. A transverse section through about the middle of the streak at this stage in the mole is represented in Fig. 20, and may be considered thoroughly typical.

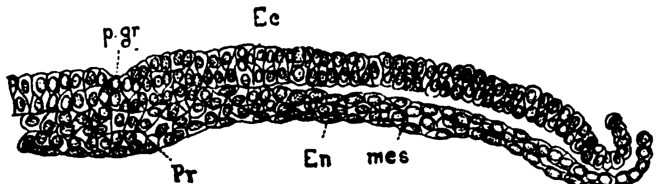


FIG. 20.—Section of the primitive streak of the mole; *prg.*, primitive groove; *Ec.*, ectoderm; *mes.*, mesoderm; *En.*, entoderm; *Pr.*, primitive streak; after Heape. (In sections nearer the hind end the groove *Pr.* does not appear; and the inner layer is distinct, though not separated axially from the middle layer.)

Blastodermic Vesicles with Primitive Streak and Head-Process.— In the stage we are now considering the axial thickening becomes sub-divided into two parts, an anterior known as the head-process, (Kopffortsatz), and the true primitive streak. The two are distinguished by the fact that the axial thickening in the region of the process is separated from the outer layer, but fused with the inner layer, while in the region of the streak it is united with the outer layer. At this stage we find further that, except at the anterior end, *i. e.*, in the region of Hensen's knot, the axial thickening of the streak is not connected with the inner layer. Hence cross sections may give us three different appearances, according to the level at which they are taken.

The head-process was first distinguished, so far as I am aware, by Kölliker, *32*, also (Entw. ges., 1879, p. 271). Lieberkühn, *42*,

first showed that in it appears a small longitudinal canal, the walls of which form the notochord. Heape, *23*, discovered that the hinder end of this canal opens exteriorly in the mole, and Bonnet, *10*, made the same observation on sheep. Strahl describes the "process" in the rabbit incidentally in his paper on cloaca, *63*; additional information is given by Bonnet, *11*, 65–75, concerning the sheep, and by C. Rabl, *44*, concerning the rabbit. Especially valuable is Fr. Carius' dissertation, *13*. In the guinea pig, according to Carius, after the formation of the primitive streak, the middle layer grows out in *all* directions, and lies free between the inner and outer layers. In front of the primitive streak the outgrowth takes place in three divisions, one median, two lateral. The median outgrowth is the head-process, and it becomes later united with the inner layer, but at first lies entirely free (embryo of 13–14 days). The first indication of the formation of a canal is an alteration of form in the cells, which elongate in directions at right angles to the axis of the head-process, so that their oval nuclei are radially placed. The change begins posteriorly and progresses forward; while it is going on, the anterior extremity of the head-process fuses with the inner layer. The radial cells move apart, so that there arises a longitudinal canal; subsequently the canal loses its inferior wall, so that it becomes continuous as a cavity with the cavity of the vesicle formed by the inner layer. In the rabbit the head-process is always free at first, but very early unites with the inner layer, in which condition it was found by Carius, *13*, 18–19, at 7½ days.[2] In the rabbit Hensen's knot presents at this stage a small depression (the front end of the primitive groove), into which a small plug of tissue projects up from the underlying axial thickening (Carius, Fig. 7); Van Beneden homologizes this with the anus of Rusconi and its plug of yolk matter, but inasmuch as the rabbit and bats are the only mammals known to have such a plug, and as the anus of Rusconi is necessarily at the hind end of the primitive streak, Van Bene-

[2] C. Rabl, *44*, 143–145, states expressly that in the rabbit the axial thickening is not connected with the inner layer, either under the head-process or under the primitive streak. He differs from other investigators in this so much that I think his preparations were probably defective; indeed his own figures suggest at once that the inner layer has been artificially separated from the overlying ones.

den's homology seems to me utterly baseless. The relations of the head-process in the sheep are very much as in the rabbit, Bonnet, *11*, 65–67; the cells of the middle layer are at first free as they grow forward to form the process, but subsequently are found united with the inner layer.

The head-process (cf. Lieberkühn, *43*) probably always grows, as is certainly the case in the guinea pig, at its hinder end and at the expense of the primitive streak; it is, I think, in this manner that the often-noticed shortening and final disappearance of the streak is effected. The back growth of the process establishes the necessary condition for the growth of the notochord at its hind end.

Homologies of the Mammalian Blastocyst.—There is at present no satisfactory and generally accepted interpretation of the parts of the mammalian blastocyst as compared with the corresponding stages of other vertebrates. The principal difficulties are two, namely: 1, the development of the two-layered stage; 2, the identification of archenteric cavity.

1. The two-layered stage is said to develop by an *inner* layer growing out in all directions from the inner mass of cells left at the close of segmentation. Now we must look on this statement with great suspicion, because in *all* other vertebrates it is the ectoderm which grows over the ovum; it is therefore improbable that in mammals it is the entoderm; and, in fact, I cannot find anywhere any definite observations to show that it is the inner layer the spreading of which renders the blastodermic vesicle two-layered. If the current statement proves erroneous, then we shall gain much towards a direct comparison of mammalian development with that of other vertebrates.

2. The permanent archenteric cavity arises from two sources, namely: the large space of the vesicle enclosed by the inner layer, and secondly, the so-called chorda-canal of the Kopffortsatz. Concerning the homologies of the latter, three views have been advanced: 1, it is the homologue of the tubular notochord; 2, it is the true archenteric cavity (E. Van Beneden, *3*); 3, it is the blastoporic canal (Minot, 1887, Buck's Reference Handb., VI., p. 247). The third view is the one which I adopt.

Against the first view it is to be urged that the tubular stage ot the notochord does not appear actually, but is assumed for lower vertebrates, because the chorda appears in them as a *groove* and as afterwards separated off, and although it is then a solid rod of cells it has been considered to represent an epithelial tube; moreover, this stage occurs after the notochord is permanently separated from the entoderm, and finally the whole of the rod of cells (or walls of the chordal tube) participates in the formation of the notochord. The mammalian "chorda-canal" is a true tube, which the notochord is not; it fuses with the entoderm, and the true notochord is separated off subsequently, only the dorsal part of its walls produces notochordal cells. These characteristics are, on the other hand, precisely those which belong to that hinder portion of the archenteron which we call in other vertebrates the blastoporic canal; this canal produces the notochordal cells from its dorsal wall; it passes through a mass of cells, and lies in Sauropsida (the vertebrates nearest the mammals) above the archenteric cavity proper. Against the second view—E. Van Beneden's—that the "chorda-canal" is the archenteron, it is to be remarked that the archenteron is bounded above by entodermal cells and below by the entodermal yolk, and the representative of the yolk is not to be found in the lower wall of the "chorda-canal." Hence it seems to me clear that Minot's view is the only defensible one, for the chorda-canal agrees in its essential features with the blastoporic canal of vertebrates, and only with that canal.

If this homology is correct then the canal must lead into the archenteron; hence the large space within the inner layer must be homologous with the archenteron, because the chorda-canal opens into it. This leaves us still entirely in the dark as to how the development of the mammalian entodermal canal is to be homologized with its development in other vertebrates.

According to the view I have advocated, the blastoporic canal of mammals is peculiar in persisting for a long time as a separate canal above the archenteron, and then losing its lower wall along a considerable stretch at once; in other vertebrates it loses in front as fast as it grows behind, so that it is always short.

As regards the homologies of the layers, I consider that the outer layer of the vesicle is ectoderm, and the thickening which constitutes the embryonic shield corresponds to the ectodermal thickening of the embryonic area in Sauropsida; the inner layer and the lining of the "chorda-canal" (blastoporic) is the entoderm; the remaining tissue of the primitive streak and head-process, together with the middle layer, constitute the mesoderm. In order not to prejudge the question, the names of the germ-layers have not been used in the preceding description of the blastodermic vesicle.

Inversion of the Germ-Layers in Rodents.—In many but not all rodents the outer layer, Rauber's Deckschicht, of the embryonic shield undergoes a remarkable hypertrophy immediately after the close of segmentation proper; the deckschicht, together with the ectoderm underlying it, becomes a plug which pushes in the other layers, thereby profoundly altering the topography of the ovum. In the mole, Heape, *23*, the hypertrophy is not very great, and the plug disappears soon, so that there is no great change; in guinea pigs, mice, and Arvicola the plug becomes very large, and remains for a long time. The plug is very long, and the ovum elongates with it, changing into an almost cylindrical vesicle (Selenka's *Keimcylinder*). The plug becomes hollow, and the cells corresponding to the deckschicht become separated from those which are to form the ectoderm of the embryo. Three modifications of the hollowing out of the plug and of the separation of its two parts are known. The changes referred to are very clearly illustrated by Selenka, *56*, Taf. XVI., in a series of comparative diagrammatic figures. In the simplest case, Fig. 21, the plug acquires a single cavity, *a*; the cells around the upper end, *D*, correspond to the deckschicht, and serve partly to attach the ovum to the uterine walls; the cells, *Ec*, around the lower end of the cavity become the embryonic ectoderm; all the cells around the cavity, *a*, are homologous with the outer layer of the embryonic shield of other mammals. The cavity, *c*, of the vesicle is very much reduced; the inner side of the shield, *i. e.*, of the plug, is lined by an inner layer, *en*, which gives rise to the entoderm. The outer layer of the vesicle is very thin, and is found to unite very closely

with the walls of the uterus. Hence, when the uterus is opened only the hollow plug and its covering of entoderm can be removed; as it makes a two-walled vesicle, it was considered to represent by itself the two-layered stage of the blastodermic vesicle. Thus it came that Bischoff believed that in various rodents the ectoderm lies inside, the entoderm outside. Bischoff's observations, *8*, *9*, which have been confirmed by Reichert, *47*, are correct, but the inversion of the layers is apparent, not real. The actual homologies were not discovered until the improvements in microscopic technique enabled Selenka, *55*, *56*, and Kupffer, *38*, to make sections of uteri with ova in situ, and in their sections to find the true outer layer. Their observations removed at once the apparent anomaly in the position of the germ-layers. Their results have been in the main confirmed by Fraser, *20*, and extended to another species by Biehringer, *5*.

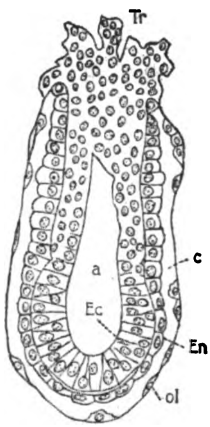


FIG. 21.—Blastodermic vesicle of *Mus sylvaticus*, after Selenka. *a*, cavity of träger; *Ec.*, ectoderm; *c*, cavity of blastodermic vesicle; *En.*, entoderm, *ol.*, outer layer.

In *Mus decumanus* the ectodermal cells early become a separate spherical mass, thus dividing the plug into two parts; a cavity appears in each part; these two cavities soon become confluent, and the inner layer of cells having meanwhile developed, the relations become essentially identical with those in *Mus sylvaticus*, Fig. 21. In *Mus musculus* the development is similar, but there is the additional peculiarity that the deckschicht is regularly invaginated at first, so as to form a small pit, into which living tissue grows. In Arvicola this invagination is more marked and lasts longer, but in both cases it is early obliterated.

Arvicola represents the second modification mentioned above; it has not only the invagination to distinguish it, but also the very early formation of the cavity of the plug as a fissure between the deckschicht and the true ectoderm cells.

The guinea pig offers the third modification, and is characterized by the early complete separation of the plug into its two parts;

the deckschicht remains at one end of the ovum and forms the träger; it acquires an independent cavity of its own; the ectodermal portion of the plug forms a solid spherical mass, which is transported to the opposite pole of the ovum; it subsequently becomes hollowed out, presenting a space, which, as the later development shows, is the amniotic cavity. The inner layer passes from the edge of the träger around the sphere of ectoderm; if the two parts of the plug were connected the relations of the inner layer would be the same as in *Mus sylvaticus*, Fig. 21.

The subsequent development of the rodents with inverted layers is modified in various secondary features, which it will be unnecessary for us to study. In all typical respects the embryonic development agrees with that of other mammals, even as to details.

Blastopore.—The blastopore is the small opening which is situated at the end of the primitive streak, and leads into the archenteric cavity; the portion of the archenteron, which is next the blastopore, is a narrow passage through the thick mass of cells which make the posterior part of the primitive streak; this passage is called the blastopore canal; from its dorsal wall the cells arise which form the notochord.

While concrescence is going on the blastopore changes its position, being always at the end of the archenteron; after concrescence is completed the archenteron expands so as to extend below the primitive streak, behind the blastopore; hence the blastoporic canal appears as shown in Fig. 22, like a separate tube; it must not, however, be forgotten that it is part of the archenteron.

The blastoporic canal remains open in marsipobranchs, ganoids, amphibians, and selachians, and is well known. It is also found in all the amniota, but the recognition of its occurrence in this group was long hindered by the fact that it does not exist at first as a canal. The blastopore is the opening of a tube through the primitive streak; now if the cavity of this tube is obliterated by its walls growing together, then the primitive streak would become a solid mass of cells; this is the condition we actually find in the amniota, Fig. 22 A; since the posterior part of the primitive streak is morphologically the thick walls of the blastopore, the homologies are not altered by the temporary ob-

literation of the canal, which moreover appears as such in later stages. Its development has been especially studied in reptiles

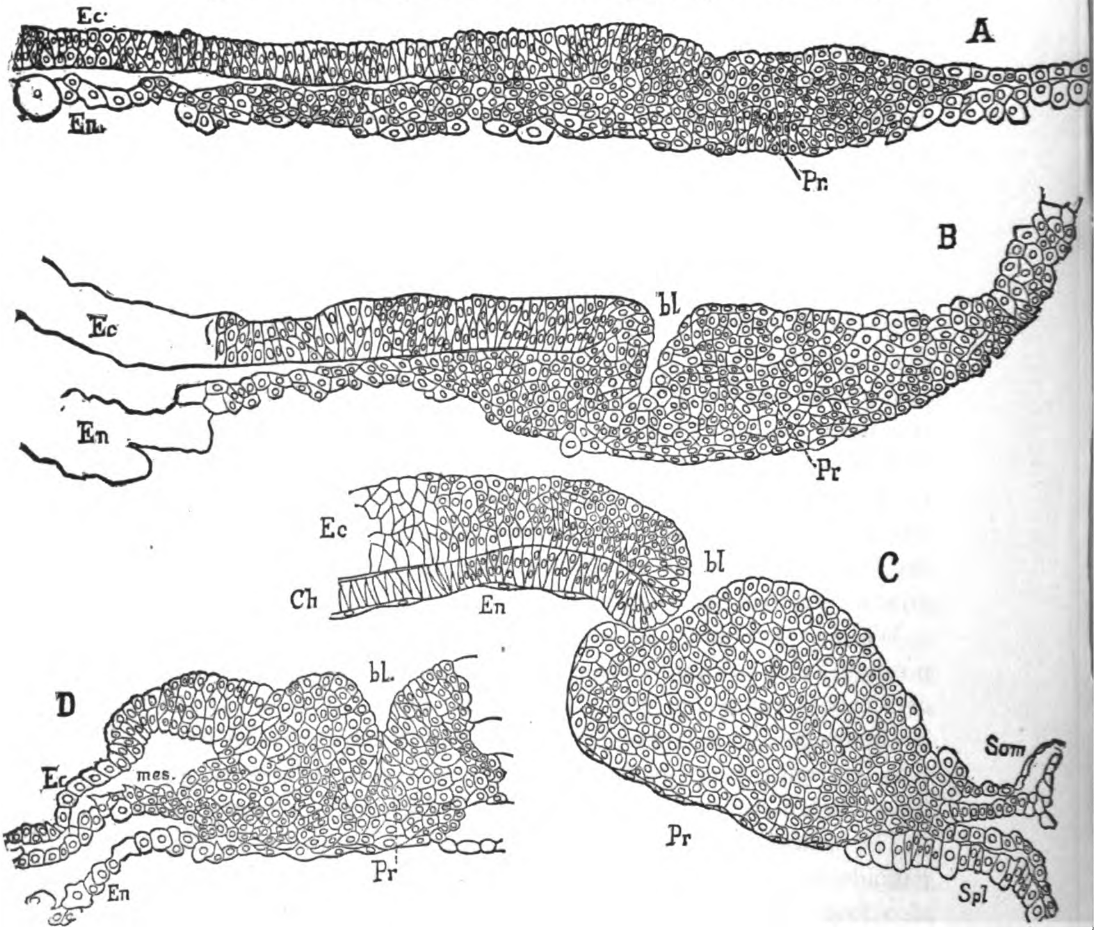


FIG. 22.—Formation of the blastoporic canal in *Lacerta muralis*, after Weldon. A, B, C, longitudinal sections of three successive stages of the blastoderm, which in each case has been removed from the yolk; the space under the entoderm, *En.*, is the archenteric cavity. D, tranverse section of the posterior part of the blastopore, a little younger than C. *Ec.*, ectoderm; *En.*, entoderm, *Pr.*, primitive streak; *bl.*, blastopore; *Ch*, notochord; *mes.*, mesoderm. Fig. B, *bl.* This pit soon becomes a complete perforation.

by Weldon, *66*, Kupffer, *37*, *39*, H. Strahl, *58*, *59*, *60*, *61*, *62*, Hofmann, in Braun Thierrich, pp. 1892-1897, and others; it begins as a pit upon the external surface.

Concrescence involves necessarily the gradual recession of the blastopore; in most vertebrates the blastoporic canal merges at its front end into the main archenteric cavity, but in mammals, if the homologies I have drawn above be correct, the canal persists for a considerable period as the "chorda-canal" of German writers.

The blastopore is not homologous with the gastrula mouth, but is merely a small portion thereof; in front of it the gastrula mouth is closed by concrescence; while concrescence is going on there will be a part of the gastrula mouth open behind the blastopore; when concrescence is completed the blastopore is at the end of the elongated gastrula mouth, the lips of which are united throughout the remainder of their length. The blastopore is not a fixed point, being merely the opening of the closed archenteron, and as by concrescence the archenteron is elongated, in precisely the same measure the blastopore travels backward.

AUTHORITIES CITED.

1. Beneden, Ed. van. La maturation de l'oeuf, la fécondation et les premières phases du développement embryonnaire des mammifères d'après des recherches faites chez le Lapin. *Journ. Zool.*, V., 10–56, 1876.

2. ——. Recherches sur l' embryologie des mammifères. La formation des feuillets chez le Lapin. Arch Biol., I., 136–224. Pls. IV.–VI., 1880.

3. ——. Untersuchungen über die Blätterbildung den Chordakanal und die Gastrulation bei den Säugetieren. Anat. Anz., III., 709–714, 1888.

4. Beneden, Ed. Julin, Charles. Recherches sur la formation des annexes foetales chez les mammifères (Lapin et Cheiroptèra). Arch. Biol., V., fasc. 3, pp. 369–434. Pls. XX.–XXIV., 1884.

5. Biehringer, Joachim. Ueber die Umkehrung der Keimblätter bei der Scheermaus (*Arvicola amphibius* Desm,). Arch. Anat. Physiol. Anat. Abth., 279–286. Taf. XVII., 1888.

6. Bischoff, Theo. L. W. Entwickelungsgeschichte des Kanincheneies Braunschweig, 4°, pp. X., 154. 16 Taf., 1842.

7. ——. Entwicklungsgeschichte des Hunde-Eies. Braunschweig, 134 pp., 15 Taf., 1845.

8. —— Entwicklungsgeschichte des Meerschweinchens. Giessen, 4°, pp. 56. Taf. VIII., 1852.

9. ——. Neue Beobachtungen zur Entwicklungsgechichte des Meerschweinchen. Abth. Bayr. Akad, cl. 2. X., 115–166. Taf. VII.–X., 1870.

10. Bonnet, R. Beiträge zur Embryologie der Wiederkäuer gewonnen am Schafei. Arch. f. Anat. u. Entwick. Anat. Abth., 170–230. Taf. IX.–XI., 1884.

11. ——. Beiträge zur Embryologie der Wiederkäuer gewonnen am Schafei (Fortsetzung). Arch. f. Anat. u. Physiol. Anat. Abth., 1–106, Taf. I.–VI., 1889.

12. Braun, M. Die Entwicklung des Wellenpapageis (*Melopsittacus undulatus* Sh.) Thiel I.–II. Arb. zool., zool. Inst. Würzburg, V., 161–204; 205-341 Taf. VIII.–XIV., 1882.

13. Carius, Fr. Ueber die Entwicklung der Chorda und der primitiven Rachenhaut bei Meerschweinen und Kaninchen. 8vo, pp. 33, Taf. I. Marburg (Inaug. Diss.), 1888.

14. Coste, Jean Jacques. Histoire générale et particulière du Developpement des corps organisés. 4°, I., II. (une fascicule,) 1859. Atlas folio, 50 Pl. Paris. Victor Masson, 1847.

15. Disse, J. Die Entwicklung des mittleren Keimblattes im Hühnerei. Arch. f. mikr. Anat., XV., 67–94. Taf. V., 1878.

16. ——. Die Enstehung des Blutes und ersten Gefässes im Hühnerei. Arch. f. mikr. Anat., XVI., 545–592. Taf. XXVI.–XXVIII., 1879.

17. Duval, M. Études sur la ligne primitive de l' embryon du poulet. Ann. Sci. Nat., 7 Sér. VII., Art. 7 48 pp., Pls. XIII.–XVIII., 1878.

18. ——. De la formation du Blastoderme dans l' oeuf d' oiseau. Ann. Sci. Nat. Zool., XVIII., Ser. 6, 1–208, Pls. I.–V., 1884.

19. Études histologiques et morphologiques sur les annexes des embryon d' oiseau. Robin's *Jour. Anat. et Physiol.*, XX., 201–241, Pl. IX.–XII., 1884.

20. Fraser, A. On the Inversion of the Blastodermic Layers in the Rat and Mouse. Proc. Roy. Soc. London, XXXIV., 430–437, 1883.

21. Gasser, E. Ueber den Primitivstreif bei Vogelembryonen. Sitzb. Ges. Beförd ges. Naturw. Marburg. 100–103, 1877.

22. ——. Der Primitivstreifen bei Vogelembryonen (Huhn and Gans). Schriften Ges. Beförd. ges. Naturw. Marburg., II., 1–98. Taf. I.–X., 1879.

23. Heape, Walter. The development of the mole (*Talpa europea*). The formation of the germinal layers, and development of the medullary groove and notochord. *Q. J. M. S.*, XXIII., 412–452, Pl. XXVIII.–XXXI. Studies Morph. Lab. Cambridge, II., 29–75, Pl. VI.–IX., 1883.

24. Hensen, Victor von. Beobachtungen ueber die Befruchtung und Entwickelung des Kaninchens und des Meerschweinchens. Zeitschr. Anat. Entwick., I., 211–213; 353–423. Taf. VII.–XII., 1876.

25. His, Wilhelm. Untersuchungen über die erste Anlage des Wirbelthierleibes. Die erste Entwickelung des Hühnchens im Ei. Leipzig, 237 pp., 12 Taf., 1868.

26. ——. Untersuchungen über die Entwicklung der Knochenfische, besonders über diejenige der Salmens. Z. f. Anat. u. Entwick., I., 1–39, Taf. I.–II., 1876.

27. ——. Ueber die Bildung der Haifischenembryonen. Zeitsch. f. Anat, u. Entwick., II., 108–124. Taf. VII., 1877.

28. ——. Neue Untersuchungen über die Bildung des Hühnerembryo. I. Arch. f. Anat. u. Phys., Anat. Abth., 112–187. Taf. V.–VI., 1877.

29. ——. Die Lehre von einem Bindesubstanzkeim (Parablast), Ruckblick nebst Besprechung einiger neuerer entwicklungsgeschlichtlicher Arbeiten. Arch. f. Anat. u. Phys., Anat. Abth., 12–108, 1882.

30. KOLLER, C. Beiträge zur Kenntniss des Hühnerkeims im Beginne der Bebrütung, Sitzb. Akad. Wiss., LXXX., III Abth., 316–329. Taf. I., 1879.

31. ——. Untersuchungen über die Blätterbildung am Hühnerkeim. Archiv. f. mikr. Anat., XX., 174–211. Taf. X.–XII., 1882.

32. KÖLLIKER, A. Ueber die Chordahölle und die Bildung der Chorda beim Kaninchen. Sitzb. Würzburg Phys. Med. Ges., 2–9, 1883.

33. KOLLMANN, J. Gemeinsame Entwickelungsbahnen der Wirbelthiere. His, Arch., 279–306. Taf. XII., 1885.

34. KUPFFER, C. Untersuchungen über die Entwicklung des Harn- u. Geschlechts-systems. Arch. f. mikr. Anat., II., 473–489. Taf. XXIV., 1866.

35. ——. Beobachtungen über die Entwicklung der Knochenfische. M. Schultze's Arch. f. mikr. Anat., IV., 209–272. Taf. XVI.–XVIII., 1868.

36. ——. Die Gastrulation an den Meroblastischen Eiern der Wirbelthiere und die Bedeutung des Primitivstreifens. Arch. f. Anat. u. Phys., Anat. Abth., 1–28, 139–154. Taf. I.–IV., VIII.–IX., 1882.

37. ——. Ueber active Betheiligung des Dotters am Befruchtungsacte bei Bufo variabilis und vulgaris. Sitzb. Münch. Acad., XII., 608–618, 1882.

38. ——. Das Ei von Arvicola arvalis und die Verineintliche Umkehr der Keimblätter an demselben. Sitzb. math.-phys. Klasse, Münchener Akad., 621–637. 1 Taf., 1882.

39. ——. Die Gastrulation an den Meroblastischen Eiern der Wirbelthiere und die Bedeutung des Primitivstreifs. Fortsetzung. Arch. f. Anat. u. Physiol., Anat. Abth., 1–40. Taf. I.–II., 1884.

41. LIEBERKÜHN, N. Ueber die Keimblätter der Säugethiere. Gratulationschrift zur 50-jährigen Doctor-Jubelfeier des Herrn Hermann Nasse. Funzigjahe Doctor-Jubelfeier Herrn Hermann Nasse. Marburg, 4°, 26 pp. 1 Taf., 1879.

42. ——. Ueber des Chorda bei Säugethieren. Arch. f. Anat. u. Phys., Anat. Abth., pp. 399–438. Taf. XX.–XXI., 1882.

43. ——. Ueber die Chorda bei Säugethieren. Fortsetzung, Arch. Anat. Phys., Anat. Abth., pp. 435–452. Taf. XIX., 1884.

44. RABL, C. Theorie des Mesoderms. Morph. J. B., XV., 113–250. Taf. VII.–X., 1889.

45. RAUBER, A. Die erste Entwickelung des Kaninchens. Sitzb. Leipzig nat. forsch. Ges., 103, 1875.

46. ——. Primitivrinne und Urmund. Beitrag zur Entwicklungsgeschichte des Hühnchens. Morphol. Jahr., II., 550–576. Taf. XXXVII.–XXXVIII., 1876.

47. REICHERT, C. B. Beiträge zur Entwickelungsgeshichte des Meerschweinchens. Abhand. k. Akad. Wiss., Berlin, 97-216, 1862.

48. RÜCKERT, J. Ueber die Anlange des mittleren Keimblattes und die erste Blutbildung bei Torpedo. Anat. Anz., II. (4) 97–112; (6) 154–176, 1887.

49. RYDER, J. A. Development of the Silver Gar (*Belone longirostris*), with observations on the genesis of the blood in embryo fishes, and a comparison of fish ova with those of other vertebrates. Bull. U. S. Fish. Comm., I., 283–335. Pl. XIX.–XXI., 1881.

50. ——. The archistome theory. AMERICAN NATURALIST, XIX., 1115–1121, 1885.

51. ——. On the formation of the embryonic axis of the teleostean embryo of the blastoderm. AMERICAN NATURALIST, XIX., 614–615, 1885.

52. SCHÄFER, E. A. Description of a mammalian ovum in an early condition of development. Proc. Roy. Soc., XXIV., 399–403. Pl. X., 1876.

53. SCHWARZ, D. Untersuchungen des Schwanzendes bei Embryonen der Wirbelthiere. Zeitschr. wiss. Zool., XLVIII., Aft. 2, 191–224. Taf. XII.–XIV., 1889.

54. SEMPER, CARL. Die Verwandschaft beziehungen der gegliederten Thiere, III., Strobilation und Segmentation. Semper's Arbeit. zool., zool. Instit. Würzburg., III., 115–404. Taf. V.–XV., 1876.

55. SELENKA, E. Studien über Entwicklungsgeschichte der Thiere, I Heft. Keimblätter und Primitivorgane der Maus. Weisbaden, Kreidel 4°, pp. 32. Taf. IV., 1883.

56. ——. Studien über Entwicklungsgeschichte der Thiere, III., Die Blätterumkehrung im Ei der Nagethiere. Wiesbaden, Kreidel, 4°, pp. 99. Taf. XI.–XVI., 1884.

57. ——. Studien über Entwickelungsgeschichte der Thiere, Heft. IV., Das Opossum (*Didelphys virginiana*), I Hälfte, 4°, pp. 101–132. Taf. IX., 1886.

58. STRAHL, H. Ueber den Canalis-myelo-entericus der Eidechse. Marburger Sitzb., 37–41, 1880.

59. ——. Ueber die Entwicklung der Allantois der Eidechse. Marburger Sitzb., 47–49, 1880.

60. ——. Zur Entwicklung des canalis-myelo-entericus der Eidechse. Marburger Sitzb., 54–55, 1880.

61. ——. Beiträge zur Entwicklung von Lacerta agilis (aus dem anatomischen Institute zu Marburg). Arch. f. Anat. u. Phys., Anat. Abth., 242-278, 1882.

62. ——. Beiträge zur Entwickelung der Reptilien. His, Arch., Anat. Abth., pp. 1–43. Taf. I., 1883.

63. ——. Zur Bildung der Cloake des Kaninchenembryo. Arch. Anat. Phys., Anat. Abth., 156–168. Taf. IV., 1886.

64. WALDEYER, W. Bemerkungen ueber die Keimblätter und die Primitivstreifen bei der Entwicklung der Hühnerembryo. Z. rat. Med. XXXIV., 159–178. Taf. X.-XI., 1869.

65. ——. Archiblast and Parablast. Arch. f. Mikr. Anat. XXII., 1-77, 1883.

66. WELDON, A. B. Note on the early development of *Lacerta muralis*, *Q. J. M. S.*, XXIII., 134-144, Pls. IV.-VI., 1883.

67. WHITMAN, C. O. The Embryology of Clepsine. *Quarterly Journ. Microscop. Science*, N. S., XVIII., Pls. XII.-XV., 1878.

68. ——. A rare form of the blastoderm of the chick, and its bearing on the question of the formation of the vertebrate embryo. *Q. J. M. S.*, XXIII., N. S., pp. 375-397, Pls. XXIV.-XXV., 1883.

69. ZUMSTEIN, J. J. Ueber das Mesoderm der Vogelkeimsscheibe (Huhn und Ente), 8 vo., p. 56. Bern (Inaug. Diss.), 1887.

THE HISTORY OF GARDEN VEGETABLES.

BY E. L. STURTEVANT.

(Continued from page 646.)

SKIRRET. *Sium sisarum* L.

THIS plant seems to have been unknown to the ancients; certainly no mention can be found of an umbillifer with grouped and divergent roots, the peculiarity of the Skirret alone among European cultivated plants of this order. In the sixteenth century the name *siser* was applied to the carrot as well as to the Skirret, as by Camerarius[1] who describes *siser*, the *sisaron* of the Greeks, as a correct Skirret, and under *siser alterum*, Italian *carota bianca*, German *gierlin*, Spanish *chirivias*, French *chervy* or *girolles* or *carottes blanche*, as a carrot, and other illustrations of this period and earlier might be given. Fuchsius[2] in

[1] Camerarius. Epitome, 1586, 226, 227.

[2] Fuchsius. De Stirp., 1542, 752.

1542 figures the Skirret, as does also Ruellius[3] in 1550, Tragus[4] in 1552, and many others after this time, and it was well known in Europe as a plant of culture at this period. It perhaps came, says Decandolle,[5] from Siberia to Russia, and from thence into Germany. It is not named by Turner[6] in 1538, but is in 1551,[7] and in 1570 the Adversaria gives the English name as *scyrret*. It was in American gardens in 1775.[8] There are no varieties described.

The modern names of the *Skirret* are: In France, *chervis, chirouis, giroles;* in Germany, *Zuckerwurzel;* in Flanders, *suikerwortel;* in Denmark, *sukkerrod;* in Italy, *sisaro;* in Spain, *chirivia tudesca;* in Portugal, *cherivia;*[9] in Scotland, *crummock;*[10] in India, *cheena aloo;*[11] in Japan, *muskago nisin sjakuna.*[12]

The ancient names, as given by J. Bauhin,[13] are: For Germany, *gierlin, gierlen, geyerlein, gorlin, gerlin, klingei, rublin, garten rapunzel, zam rapunzel, klein morellen, klingel mohren, girgele, girgelin,* and, above all others, *zucker wurtzel;* in Belgian, *suycker wortelen, serillen;* in French, *esthervis, chervits, chervy, gyroles;* in Italy, *sisaro;* in Spain, *cherivias, chirivias, chirimas;* in English, *scyrret.*

SNAILS. *Medicago scutellata* All.

This plant is not edible, but like the caterpillar-plant is grown on account of the singular shape of its seed-vessels. It was in Belgian and German gardens preceding 1616,[14] and in American gardens in 1863 or before.[15]

Called in France, *limacon;* in Germany, *schnirkel-schnecke, schneckenklee;* in Spain, *caracol.*[16]

[3] Ruellius. Diosc., 1550, 239.
[4] Tragus. De Stirp., 1552, 911.
[5] Decandolle. Orig. Des Pl. Cult., 31.
[6] Turner. Libellus, 1538.
[7] Bauhin. Pin., 1623, 155.
[8] Romans. Nat. Hist. of Fla., I., 115.
[9] Vilmorin. Les Pl. Pot., 87.
[10] McIntosh. Book of the Gard., II., 229.
[11] Speede. Ind. Handbook of Gard.
[12] Thunberg. Jap., 118.
[13] J. Bauhin. Hist., 1651, III., pt. 2, 154.
[14] Dodonæus. Pempt., 1616, 575.
[15] Burr. Field and Gard. Veg., 1863, 398.
[16] Vilmorin. Les Pl. Pot., 321.

SOJA BEAN. *Soja hispida* Moench.

This leguminous plant, although popular in eastern countries, can scarcely be expected to obtain a foot-hold in European or American gardens. According to Bretschneider,[17] a Chinese writing of 163–85 B. C. records that Shen nung, 2800 B. C., sowed the five cereals, and another writing of A. D. 127-200 explains that these five cereals were rice, wheat, *Panicum italicum*, *P. miliaceum*, and the Soja. The same are also mentioned in the "Classics." The use of this bean as a vegetable is also recorded in authors of the fifth, fourteenth, and sixteenth centuries. The first mention of Soja that I note is by Kæmpfer,[18] who was in Japan in 1690, and in his account of his travels he gives considerable space to this plant. It also seems to be mentioned by Ray[19] in 1704. It is much cultivated in China and Cochin-china.[20] There are a large number of varieties,—"as many as you have of beans," as a Japanese friend informed me. Seed was brought from Japan to America by the Perry Expedition on its return, and were distributed from the U. S. Patent Office[21] in 1854. I have since then received some of the seed from the South under the name of the cow-pea. In France the seed received distribution in 1855.[22] In 1869 Martens[23] describes thirteen varieties.

The *Soja Bean* is called in France, *soja*, *pois oleagineux de la Chine;* in Germany, *soja-bohne;*[24] in Japan, *daidsu* or *mame*, the send *miso;*[25] in China, *yeou-teou*.[22]

In some of its varieties this bean may be found useful for forage purposes, or perhaps for field culture.

SORREL. *Rumex* sp.

The Sorrels are much used in many parts of Europe, but they do not seem to be popular in English-speaking countries. A

[17] Bretschneider. Bot. Sin., 75, 78, 52, 59.
[18] Kæmpfer. Amoen., 1712.
[19] Ray. Hist. Suppl., 1704, 438.
[20] Loureiro. Fl. Cochinch., 441.
[21] U. S. Pat. Of. Rept., 1854, XV.
[22] Paillieux. Le Soya, 1881, 5.
[23] Martens. Die Gartenbohne, 1869, 103-5.
[24] Vilmorin. Les Pl. Pot., 549.
[25] Thunberg. Jap., 282.

number of species have been brought under culture, but the varieties referred to *Rumex acetosa*, *R. montanus*, and *R. scutatus* are now the only ones described by Vilmorin as under European vegetables.

Rumex acetosa L.

This species is very extensively used in France, and has four varieties.[26] It was formerly much cultivated in England for its leaves, which were used as spinach or in salads, and are agreeably acid. It is mentioned in nearly all the earlier botanies, and by Gerarde[27] in 1597, as under culture in England, who also figures the blistered variety. It is spoken of in nearly all the later writers on garden subjects, and was in common use in 1807,[28] but in 1874 is said to have been for many years entirely discarded, the French Sorrel having usurped its place.[29] The broad-leaved form was in American gardens in 1806.[30] This plant is in great favor with the northern natives, as the Laplanders,[31] the Hebrideans,[32] etc., and in its varieties is largely cultivated.

The *common sorrel*, *sorrel*, or *green sauce*[33] is called in France, *oseille commune*, *aigrette*, *oseille longue*, *surelle*, *surette*, *vinette*; in Germany, *Sauerampfer*, *Sauerling*; in Flanders and Holland, *zuring*; in Denmark, *almindelig syre*; in Italy, *acetosa*, *acetina*, *erba perpetua*; in Spain, *acedera*, *agrella*; in Portugal, *azedas*;[26] in Greece, *xunethra*, *zinitra*, *oxalithi*;[34] in the Mauritius, *oseille*;[35] in India, *oovlaeeta chooka*.[36]

Rumex scutatus L.

This species is mentioned in England by Gerarde[27] in 1597, but he does not indicate its general cultivation; he calls it oxalis

[26] Vilmorin. Les Pl. Pot., 393.
[27] Gerarde. Herbal., 1597, 319.
[28] Miller's Dict., 1807.
[29] Booth. Treas. of Bot., 1874.
[30] McMahon. Am. Gard Kal., 1806, 320.
[31] Lightfoot. Fl. Scot., I., 191.
[32] *Jour. of Agr.*, II., 379.
[33] Johnson. Useful Pl., 222.
[34] Pickering. Ch. Hist., 365.
[35] Bojer. Hort. Maur., 272.
[36] Speede. Ind. Handb. of Gard., 154.

franca seu romana. It is more acid than the preceding species, and has displaced it largely from English culture. It is mentioned by many of the early botanists, and is under extensive culture in continental Europe.[37] It was in American gardens in 1806,[30] but is now scarcely cultivated, as would seem from its absence from our seed lists.

French sorrel,[38] *round-leaved sorrel,*[39] *buckler-shaped sorrel,*[39] or *Roman sorrel*[37] is called in France, *oseille ronde*, *petite oseille*; in Germany, *romischer sauerampfer*; in Italy, *acetosa romana*, *acetosa tonda.*[36]

Rumex montanus Desf.

This species occurs in French gardens under two varieties, the green-leaved and the crimped-leaved. The wild form, *R. arifolius* L., is often met with in France. In 1863 Burr[40] describes it among American garden esculents. In India it is said by Firminger[41] to be an excellent ingredient to use abundantly in soups, and to serve to impart a peculiarly fine flavor to omelettes.

Mountain sorrel,[40] or *maiden sorrel,*[38] is called in France, *oseille vierge*, *oseille sterile*; in Italy, *acetosa vergine.*[36]

Rumex alpinus L.

A species sometimes grown in France, but which does not appear to have entered American culture. It was grown in England by Gerarde in 1597 for use in "physicke," and is described as cultivated there in Miller's Dictionary, 1807. It is eaten as a herb in China.[42]

Pyrenean sorrel[38] is called in France, *oseille des Alpes*, *oseille des Pyrnees.*

Rumex pulcher L.

This species is said to be planted in gardens in France for use as a pot-herb, but the leaves to become very hard in summer.[43] It is, however, scarcely to be considered a garden plant.

[37] McIntosh. Book of the Gard., II., 139.
[38] Vilmorin. The Veg. Gard., 526.
[39] Mawe. Gard., 1778.
[40] Burr. Field and Gard. Veg., 308.
[41] Firminger. Gard. in Ind., 142.
[42] Smith. Mat. Med. of China, 87.
[43] Flore Nat. et Econ., etc., Pt. II., p. 497.

Rumex sanguineus L.

This weed of waste and cultivated grounds of America is mentioned, under the name Bloodwort, by Josselyn,[44] about the middle of the seventeenth century, as introduced. As Gerarde[45] in 1630 says it was sown in his time for a pot-herb in most gardens, and as Ray[46] in 1686 also says it was planted in gardens as a vegetable, we may believe that it was in former use in colonial gardens in Massachusetts. Its use is as a spinage, and for this purpose the leaves of the wild plant are occasionally collected at the present time.

Bloody-veined dock is the name under which the wild plant is now known.

SOUTHERNWOOD. *Artemesia abrotanum* L.

This aromatic plant is inconsiderably cultivated for its agreeable taste and tonic properties.[47] To some people its fragrance is very grateful. It is cultivated in most parts of China for the use of the young shoots made into cakes with meal.[48] It was apparently known to the ancients, but the references are not as clear as might be. It was described as under cultivation by the herbalists of the sixteenth century, and Turner[49] in 1538 gives its English name as *Suthernwoode.* In 1859 Gray[50] says it is found in some American gardens.

Southernwood, called in Anglo-Saxon, *sæthrenewudu* or *suthernwude,*[51] is called in France, *aurone, aurone des jardins, aurone male, citronelle, garde-robe, herbe royale, vrogne;* in Denmark, *ambra;* in Italy, *abrotano, abrotino;* in Greece, *pikrothanos;* in Egypt, *semsæk,* or *msæk,* or *meskeh;*[51] in China, *yin-chin-hau.*[48]

SPINAGE. *Spinacea oleracea* L.

This plant was unknown to the ancient Greeks and Romans, but appears to have been early used by the Arabs, and by the

[44] Josselyn. Rar., 114.
[45] Gerarde. Herb., 1633, 390.
[46] Ray. Hist., 1686, 174.
[47] Decaisne & Naudin. Man., IV., 239; Vilmorin. Les Pl. Pot., 28.
[48] Smith. Mat. Med. of China, 25.
[49] Turner. Libellus, 1538.
[50] Gray. Man. of Bot., 1859, 228.
[51] Pickering. Ch. Hist., 258.

Moors carried to Spain, from which it gradually spread to the rest of Europe.[52] The first notice I find is its occurrence in China in the seventh or eighth century,[53] and one of its names is *Po-ssv-ts'ao*, Persian herb.[54] In the Nabathean agriculture in Spain, in the twelfth century, it is called by *Ibn-al-awan*, the prince of vegetables.[55] Albertus Magnus,[56] who lived in Bavaria in the thirteenth century, describes the *spinachia* with spiny seed. Ammonius,[57] a Bavarian physician writing in 1539, says it was mentioned by Avicenna, an Arab author born in Persia in 981, and is perhaps the *aspenach* of Serapio, another Arab author of the same period. In 1536 Ruellius says it was called *spinacia* in France, and *spinachia* by the modern Greeks. In England it is mentioned by Turner[58] in 1538, who calls it *Atriplex hispaniensis* of some, *spinachia* of the English. It was new in Italy in 1558, according to Matthiolus.[59] We thus find its presence universal in Europe in the early part of the sixteenth century. Indeed its use has become for some time so extended as to supplant many other vegetables formerly grown as pot herbs.

Two races are now known in our gardens; the one with prickly seed, and the other with smooth seed. These have been described as species.

Spinacia spinosa Moench.

Spinachia. Alb. Mag., 13th Cent., Jessen Ed., 563; Fuchsius, 1542, 666, cum ic; Dod., 1616, 619, cum ic.

Binetsch, Spinat, Spinacia. Roszlin, 1550, cum ic.

Olsus hispanicus. Trag., 1552, 325, cum ic.

Spinacia. Matth., 1570, 342, cum ic; Lob. Obs., 1576, 129, cum ic., 1591; ic., 1591, I., 257; Lugd., 1587, 544, cum ic.; Ger., 1597, 260, cum ic.

[52] Targioni-Tozzetti. Hort. Trans., 1854, 148.
[53] Bretschneider. Bot. Sin., 79.
[54] Bretschneider. On the Study, etc., 16.
[55] Heuze. Les Pl. Alim., I., IV.
[56] Albertus Magnus. De Veg., Jessen Ed., 1867, 563.
[57] Ammonius. Med. Herb., 1539, 323.
[58] Turner. Libellus, 1538.
[59] Matthiolus. Com., 1558, 246.

Spanachum. Cam. Epit., 1586, 245, cum ic.

Lapathum hortense alterum, seu spinacia semine spinoso. Bauh. Phytopin., 1596, 183.

Spinachia mas. J. Bauhin, 1651, II., 964, cum ic.

Spinacia oleracea L. var. A. Lin. Sp., 2d ed., 1456.

Epinard d'Angleterre. Vilm., 1883, 203.

Large Prickly or Winter Spinage. Vil., 1885, 533.

Spinacia inermis Moench.

Spinachia nobilis. Tragus, 1552, 324.

Lapathum hortense alterum spinacia, semine non spinoso. Bauh. Phytopin., 1596, 184.

Spinacia II. Ger., 1597, 260.

Spinachia fœmina. J. Bauh., 1651, II., 964.

Spinachia semine non pungente, folio majore rotundiore. Ray, 1686, 162; Chabr., 1677, 303 cum ic.

Spinacia glabra. Mill. Dict., 1733.

Spinacia oleracea, L. var. B. Lin. Sp., 1762, 1456.

Epinards a graine ronde. Vil., 1883, 204.

Round-Seeded Spinage. Vil., 1885, 534.

Spinage was in American gardens in 1806.[60] There is but one variety of the prickly-seeded described by Vilmorin,[61] and five of the smooth-seeded form.

Spinage is called in France, *epinard;* in Germany, *spinat;* in Flanders and Holland, *spinazie;* in Denmark, *spinat;* in Italy, *spinaccio;* in Spain, *espinacia*; in Portugal, *espinafre;*[61] in Norway, *spinat.*[62]

In Arab, *sebanakh,*[63] *tæktera,*[64] *ispanaj,*[65] *isfanadsch,*[66] *esbanach;* in China, *po-ling, po-ts'ai, po-ssv-ts'ao;*[67] in Hindustani, *sag-paluk;* in Persia, *ispanaj.*[65]

[60] McMahon. Am. Gard. Kal., 1806.
[61] Vilmorin. Les Pl. Pot., 202.
[62] Schubeler. Culturpfl., 80.
[63] Delile. Fl. Æg. Il.
[64] Forskal. Fl. Æg.—Arab., XCIII.
[65] Birdwood. Veg. Prod. of Bomb., 69, 177.
[66] Decandolle. Geog. Bot., 846.
[67] Bretschneider, l. c.

SQUASH, PUMPKIN, AND GOURD.

The Squash.

The word squash seems to have been derived from the American aborigines, and in particular from those tribes occupying the northeastern Atlantic coast, and seems to have been originally applied to the summer squash, as by Wood,[68] when he says, "In summer, when their corn is spent, *isquotusquashes* is their best bread; a fruit much like a pumpkin." Roger Williams[69] writes the word "*Askutasquash*,—their vine apples,—which the English, from them call *squashes;* about the bigness of apples of several colors." Josselyn[70] gives also a new form to the word, writing "*Squashes*, but more truly *squoutersquashes*, a kind of mellon or rather gourd; for they sometimes degenerate into gourds. Some of these are green; some yellow; some longish, like a gourd; others round, like an apple; all of them pleasant food, boyled and buttered, and seasoned with spice. But the yellow squash—called an apple squash (because like an apple), and about the bigness of a pome water—is the best kind." This apple squash, by name at least, as also by the description so far as applicable, is even now known to culture, but is rarely grown on account of its small size.[71] Van der Donck, after speaking of the pumpkins of New Netherlands (1642–53), adds, "The natives have another species of this vegetable peculiar to themselves, called by our people *quaasiens*, a name derived from the aborigines, as the plant was not known to us before our intercourse with them. It is a delightful fruit, as well to the eye on account of its fine variety of colors, as to the mouth for its agreeable taste. . . . . It is gathered early in summer, and when it is planted in the middle of April, the fruit is fit for eating by the first of June. They do not wait for it to ripen before making use of the fruit, but only until it has attained a certain size. They gather the squashes, and immediately place them on the fire without any further trouble."[72] In 1683 Worlidge[73] uses the

68 Wood. New Eng. Prosp., Pt. II., c. 6.
69 R. Williams. Key, etc., 222.
70 Josselyn. Rar., p. 89.
71 Burr. Field and Gard. Veg., 1863, 207.
72 Quoted from A. Gray, *Am. Jour. of Sci.*, May, 1883, p. 377.
73 Systema Horticulturæ, by J. W. Gent, p. 211.

word squash, saying, "There are lesser sorts of them [pompeons] that are lately brought into request that are called *squashes*, the edible fruit whereof, boyl'd and serv'd up with powdered beef, is esteemed a good sawce," and Kalm[74] in his Travels says distinctly that "The squashes of the Indians, which now are cultivated by Europeans, belong to those kind of gourds which ripen before any other." These squashes of New England were apparently called sitroules by Champlain[75] in 1605, who describes them "as big as the fist." Lahontan[76] in 1703 calls the squashes of southern Canada *citrouilles*, and compares with the melon, which indicates a round form.

These "squashes," now nearly abandoned in culture, would seem to be synonymous, in some of their varieties at least, with the macock of Virginia and the Virginian watermelon described in Gerarde's Herbal[77] as early as 1621.

The Perfect Gem Squash, introduced in 1881, seems to belong to this class, and is very correctly figured by Tragus in 1552,[78] who says they are called *Mala indica*, or in German *Indianisch opffel*, and occur of four colors, saffron yellow, creamy white, orange, and black. He also gives the name *Summer opffel*, which indicates an early squash, and the names *zucco de Syria* and *zucco de Peru*, which indicate a foreign origin. To identify this claimed recent introduction as synonymous with Tragus' *Cucumis, seu zucco marinus* may seem rather improbable. The Perfect Gem and Tragus plant have the following points in common: Fruit of like form and size; so also the leaf, if the proportions between leaf and fruit as figured may be trusted; seed sweet in both; color alike, "Quae candida foris and quae ex pallido lutea sunt poma." The plants are runners in both. Compare also with the description of the Maycock, and it appears to be the same in all but color. A curious instance of survival seems to be here noted, or else the regaining of a lost form through atavism.

[74] Kalm. Trav., 1748, I., 140.
[75] Champlain. Voyages. Prince Coll., pp. 64, 75.
[76] Lahontan. Nouv. Voy., II., 61.
[77] Gerarde. Herb., 1633, pp. 919, 921.
[78] Tragus. De Stirpium, 1552, 835.

A careful comparison with the figures and the description given would seem to bring together as synonyms:

Cucumis marinus. Fuchs., 1542, 699; Roszlin, 1550, 116.

Cucumis vel zucco marinus. Trag., 1552, 835.

Cucurbita indica rotunda. Lugd., 1587, I., 116.

Pepo rotundus minor. Dod., 1616, 666.

Pepo minor rotundus. • Bodæns, 1644, 783.

Cucurbite folio aspero, sive zucchæ. Icon., IV., Chabr., 1673, 130.

The Maycock. Ger., 1633, 919.

The Perfect Gem, 1881.

The distinctions between the various forms of Cucurbits seem to have been kept in mind by the vernacular writers, who did not use the words pumpion, gourd, etc., as synonyms. Thus in 1535 Cartier[79] mentions as found among the Indians of Hochelega, now Montreal, "pompions, gourds." In 1586 Heriot[80] mentions in Virginia "pompions, melons, and gourds," and Captain John Smith[81] pumpions and macocks; Strachey,[82] who was in Virginia in 1610, mentions macocks and pumpions as differing. "Pumpions and gourds" are named by Smith[83] for New England in 1614. In 1648, at the mouth of the Susquehanna, mention is made of "symnels and maycocks."[84]

The word squash in its early use, we may hence conclude, applied to those varieties of Cucurbits which furnished a summer vegetable, and was carefully distinguished from the pumpkin. Kalm[85] in the eighteenth century distinguishes between pumpkins, gourds, and squashes. The latter are the early sorts; the gourd includes the late sorts useful for winter supplies; and the pompion or melon, the latter name and contemporary use giving the impression of roundness and size; and Jonathan Carver[86] soon after gives indication of the confusion now existing in the

[79] Cartier. Pink. Voy., XII., 656.

[80] Pink. Voy., XII., 596.

[81] Pink. Voy., XIII., 33.

[82] Strachey. Trav. into Va., 72.

[83] Smith. Desc. of New Eng., II., 16.

[84] A Description of New Albion. Force Coll., II.

[85] Kalm. Trav., 1770–1, I., 140.

[86] Carver. Travels in the Northwest in 1776, p. 211.

definition of what constitutes a pumpkin and a squash when he says, "the melon or pumpkin, which by some are called squashes," and he names among other forms the same variety, the crook-neck, or crane-neck as he calls it, which Kalm classed among gourds.

At the present time the word squash is only used in America, gourds, pumpkins, and marrows being the equivalent English name,[87] and the American use of the word is so confusing that it can only be defined as applying to those varieties of Cucurbita which are grown in gardens for table use, while the word pumpkin applies to those varieties grown in fields for stock purposes, and the word gourd to those ornamental forms with a woody rind and bitter flesh, or to the Lagenaria.

This class of Cucurbits belongs to *Cucurbita pepo*, Cogn. in in DC. Monog., II., p. 545.

Other forms distinctively known at present as squashes are added in proper sequence.

The form of Cucurbit now so generally known as *Bush* or *Summer Squash* is correctly figured in 1673 by Pancovius,[88] under the name of *Melopepo clypeatus* Tab. What may be the fruit was figured by Lobel[89] in 1591, and by Dodonæus[90] in 1616, and similar fruit with the vine and leaf by Dalechamp in 1587,[91] Gerarde[92] in 1597, Dodonæus in 1616, and by J. Bauhin[93] in 1651. By Ray[94] in 1686 it is called in the vernacular "*The Buckler* or *Simnel-Gourd*." This word cymling or cymbling, in use at the present day in the Southern States for the Scalloped Bush Squash in particular, I find used in 1648 in "A Description of New Albion," but spelled Symnels. Jefferson[95] wrote the word "cymling." In 1675, Thomson, in a poem entitled New England's Crisis, uses the word "cimnel," and distinguishes from

[87] The Vegetable Garden. Vilmorin-Andrieux. Trans. by W. Robinson. London, 1885.
[88] Pancovius. Herbarium, 1673, No. 920.
[89] Lobel, ic., 1591, I., 642.
[90] Dodonæus. Pempt., 1616, 667.
[91] Hist. Gen. Lugd., 1587, I., 618.
[92] Gerarde. Herbal, 1597, 774.
[93] J. Bauhin. Hist., 1651, II., 224.
[94] Ray. Hist., 1686, I., 648.
[95] Jefferson's Notes on Virginia, 1803.

the pumpkin. Whence the origin of the word I find no clue, but it was very possibly of aboriginal origin, as its use has not been transferred to Europe. In England it is called Crown Gourd and Custard Marrow; in the United States generally the Scalloped Squash, from its shape; or locally, cymling or pattypan,—this latter name derived from the resemblance to a crimped pan used in the kitchen for baking cakes. It was first noticed in Europe, so far as I can ascertain, in the sixteenth century, and has the following synonymy:

Cucurbita laciniata. Lugd., 1587, I., 618.
Melopepo latior clypeiformis. Lob., ic., 1591, I., 642.
Pepo maximum clypeatus. Ger., 1597, 774.
Pepo latus. Dod., 1616, 666.
Pepo latiorus fructus.. Dod., 1616, 667.
Cucurbita clypeiformis sive Siciliana melopepon latus a nonnullis vocata J. B., 1651, II., 224. (First known to him in 1561.)
Melopepo clypeatus. Pancov., 1653, n. 920.
The Buckler or Simnel-Gourd. Ray., Hist., 1686, I., 648.
Summer Scalloped.

This forms belongs to the *Cucurbita melopepo*, Lin. sp., ed. 2, p. 1435, *C. pepo*, Cogn., l.c.

The Bush Crookneck is also called a squash. Notwithstanding its peculiar shape and usually warted condition, it does not seem to have received much mention by the early colonists, and to have escaped the attention of the pre-Linnean botanists, who were so apt to figure new forms. The most we know is that Summer Crooknecks appeared in our garden catalogues in 1828,[96] and it is perhaps referred to by Champlain in 1605. It is now recommended in France rather as an ornamental plant than for kitchen use.[97] This form belongs to *Cucurbita pepo* Naudin, Ann. Sc. Nat., Ser. 4, V., 6, p. 29.

The *Winter Crookneck* squash seems to have been first recorded by Ray,[98] who received the seeds from Sir Hans Sloane and planted them in his garden, and this was the variety now known

[96] Thorburn's Cat.
[97] Vilmorin. Les. Pl. Pot., 1883, 184.
[98] Ray. Hist., 1686, I., 642.

as the Striped. It has apparently been grown in New England from the earliest times, and often attains a large size. Josselyn[99] refers to a Cucurbit that may be this, the fruit "longish like a gourd," the very comparison made by Ray. Kalm[100] mentions a winter squash in New Jersey called "crooked neck," and Carver[101] speaks of "crane-necks" being preserved in the West for winter supply. A sub-variety, the Puritan,[102] answers to Beverley's[103] description of a form which he calls Cushaw, an Indian name recognizable in the Ecushaw of Heriot, 1586. This form was grown at the New York Agricultural Experiment Station in 1884 from seed obtained from the Seminoles of Florida, and appears synonymous with the Neapolitan, to which Vilmorin applies the French synonym of Courge de la Florida.

This form of squash belongs to *Cucurbita moschata*, Cogn., l.c., p. 546.

The *Pine Apple* squash, in its perfect form, is of a remarkably distinctive character, on account of its acorn-shape and regular projection. As grown, however, the fruit is quite variable, and can be closely identified with the *Pepo indicus angulosus* of Gerarde,[104] and is very well described by Ray[105] in 1686. This variety was introduced in 1884 by Landreth, and, as I am informed, the seed came originally from Chili. It is a winter squash, creamy white when harvested, of a deep yellow at a later period. It belongs to *Cucurbita pepo*, Cogn., l.c.

The *Turban squash* is easily recognized by its special form, to which it is indebted for its name. In France this is classed with the Giravmons, and one of its trivial names is *Citroville iroquoise*. It is possibly the Chilian mamillary Indian gourd of Molina[106] in 1787, described as with spheroidal fruit with a large nipple at the end, the pulp sweet and tasting like the sweet potato. In 1856

[99] Josselyn. Rar., 89.
[100] Kalm. Trav., 1670, I, 347.
[101] Carver. Trav., 1776.
[102] Burr. Field and Gard. Veg., 1863, p. 221.
[103] Beverley. Hist. of Va., 1705, 124.
[104] Gerarde. Herbal, 1597, 774.
[105] Ray. Hist., 1686, I., 641.
[106] Molina. Hist. of Chili, 1808, I., 93.

Naudin[107] describes Le Turban Rouge, and Le Turban Nouveau du Bresil, the latter of recent introduction from South America. Its description accords with the *Cucurbita clypeiformis tuberoso* and *verrucoso*, seen by J. Bauhin[108] in 1607. The Zapillito, from Brazil, advertised by Gregory in 1880, and said by Vilmorin to have reached France from South America about 1860, resembles the Turban squash in shape. This evidence, such as it is, points to South America as the starting point of this form.

It belongs to *Cucurbita maxima*, Cogn., l.c.

The squashes of our markets, par excellence, are the *Marrows* and the *Hubbard*, with other varieties of the succulent stemmed. These found representation in our seed catalogues in 1828,[109] in the variety called Com. Porter's Valparaiso, and which was brought from Chili shortly after the war of 1812. In the *New England Farmer*, Sept. 11., 1824, notice is made of a kind of melon squash or pumpkin, of moderate size, from Chili, a few seeds being received in Boston, and which is possibly the Valparaiso. The Hubbard squash is said by Gregory, its introducer in 1857, to be of unknown origin, but to resemble a kind which was brought by a sea captain from the West Indies. The *Marblehead*, also introduced by Mr. Gregory and distributed in 1867, is said directly to have come from the West Indies. The *Autumnal Marrow* or *Ohio* was introduced in 1832, and exhibited at the rooms of the Massachusetts Horticultural Society.

This class is to be referred to *Cucurbita maxima*, Cogn., l.c., and does not appear in any of the figures or descriptions of the herbalists, so far as we can ascertain, except as hereinafter noted for Lobel.

The Pumpkin.

The word *pumpkin* is derived from the Greek *pepon*, Latin *pepo.* In the ancient Greek it was used by Galen as a compound to indicate ripe fruit, as *sukuopepona*, ripe cucumber, as also by Theophrestus *peponas*, and Hippocrates *sikuon peponia.*[110]

[107] Naudin. Ann. Des. Sc. Nat., 4th ser., VI., p. 20.
[108] J. Bauhin. Hist., 1651, II., 227.
[109] Thorburn's Cat.
[110] See Bodæus a Stapel. Theoph., 1644, 781.

The word *pepo* was transferred in Latin to large fruit, for Pliny[111] says distinctly that "*cucumeres*," when of excessive size, are called "*pepones*." By the commentators the word *pepo* is often applied to the melon. Fuchsias[112] in 1542 figures the melon under the Latin name *pepo*, German *pfeben;* and Scaliger[113] in 1566, Dalechamp[114] in 1587, and Castor Durante[115] in 1617 apply this term *pepo* or *pepon* likewise to the melon. The derivatives from the word *pepo* appear in the various European languages, as follows:

Belgian: *pepoenem*, Lob. Obs., 1576; *pompoen*, Marcg., 1648, Vilm., 1883.

English: *pepon*, Lyte, 1586; *pompon*, Lyte, 1586; *pompion*, Ger. 1597; *pumpion*, J. Smith, 1606; *pumpkin*, Townsend, 1726.

French: *pompons*, Ruel., 1536; *pepon*, Dod. Gal., 1559.

Italian: *popone*, Don, 1834.

Swedish: *pumpa*, Tengborg, 1764; *pompa*, Webst. Dict.

In English the word *melon* and *million* was early applied to the pumpkin, as by Lyte in 1586, Gerarde in 1597 and 1633, and by a number of the early narrators of voyages of discovery. Pumpkins were called gourds by Lobel in 1586, and by Gerarde in 1597, and the word gourd is at present in use in England to embrace the whole class, and is equivalent to the French courge. In France the word courge is given by Matthiolus in 1558, and Pinæus in 1561, and seems to have been used as applicable to the pumpkin by early navigators, as by Cartier in 1535. The word courge was also applicable to the Lagenaria in 1536, 1561, 1586, 1587, 1597, 1598, 1617, 1651, 1673, 1772, and is now shared with the pumpkin and squash in 1883.

Our earlier travelers and historians often recognized in the pumpkin a different fruit from the courge, the gourd, or the melon. Cartier, on the St. Lawrence in 1584 discriminates by using the words "gros melons, concombres, and courges 35,"[116] or in a

[111] Pliny, lib. XIX., c. 23, Grandsagne Ed., p. 196.

[112] Fuchsius. De Stirp., 1542, 701.

[113] Scaliger. In Lib. de Plant. Arist., 1566, 79, 110.

[114] Hist. Gen. Lugd., 1587, I., 623.

[115] Castor Durante. Herb. Novo., 1617.

[116] Cartier. Bref. Recit., etc., 1545. Reimpr. Tross., 1863.

translation "pompions, gourds, cucumbers."[117] In 1586 a French name for what appears to be the summer squash is given by Lyte as concombre marin. With this class we may interpret Cartier's names into "gros melons" pumpkins, "concombres" summer squashes, and "courge" winter crooknecks, as the shape and hard shell of this variety would suggest the gourd or Lagenaria. In 1586 Heriot, in Virginia,[118] names "macokner, according to their several forms, called by us pompions, melons, and gourds, because they are of the like forms as those kinds in England. In Virginia such of several forms are of one taste, and very good, and do also spring from one seed. They are of two sorts: one is ripe in the space of a month, and the other in two months." Heriot apparently confuses all the forms met with with the macock, which, as we have shown in our notes on squashes, appears identical with the type of the Perfect Gem Squash, or the *Cucumis marinus* of Fuchsius. The larger sorts may be his pompions, the round ones his melons, and the cushaw type his gourds, for, as we shall observe, the use of the word pompion seems to include size, and that of gourd, a hard rind. Acosta[119] indeed speaks of the Indian pompions in treating of the large-sized fruits. Capt. John Smith,[120] in his Virginia, separates his pumpions and macocks, both planted by the Indians amongst their corn, and in his description of New England in 1614 speaks of pumpions and gourds. This would seem to indicate that he had a distinction in his mind, and we may infer that the word pompion was used for the like productions of the two localities, and that the word gourd in New England referred to the hard-rind or winter squashes, for Master Graves[121] refers to Indian pompions, Rev. Francis Higginson[121] to pompions, and Wood[122] to pompions and isquouter-squashes in New England soon after its colonization, and Josselyn[123] about the same period names also

[117] Cartier. Pink. Voy., XII., 656.
[118] Heriot. Pink. Voy., XII., 596.
[119] Acosta. Nat. and Mor. Hist. of the Indies, 1604, 264.
[120] Smith. Va. Pink. Voy., XIII., 33.
[121] Mass. Hist. Soc. Coll., 1st ser., I., 118, 124.
[122] Wood. New Eng. Prosp., 1st ed., p. II.
[123] Josselyn. Rar., 89, 120.

gourds, as quoted in our notes on the squash. Kalm,[124] about the middle of the eighteenth century, traveling in New Jersey, names "squashes of the Indians," which are a summer fruit, "gourds," meaning the winter crookneck, and "melons," which we may conclude are pumpkins; Jonathan Carver [125] in 1776 of the melon or pumpkin, called by some squashes, and says the smaller sorts are for summer use, the crane-neck for winter use, and names the large oblong, and in 1822 Woods [126] speaks of pompons, or pumpions, in Illinois, as often weighing from 40 to 60 lbs.

The common field pumpkin of America is in New England carried back traditionally to the early settlement, and occurs under several forms, which have received names which are usually quite local. Such form-varieties may be tabulated alphabetically, as below as taken from Burr:

Canada. Form oblate. 14 in. diam., 10 in. deep. Deep orange yellow.

Cheese. Flattened. 16 in. diam., 10 in. deep. Deep reddish orange.

Common Yellow. Rounded. 12 in. diam., 14 in. deep. Clear orange yellow.

Long Yellow. Oval. 10 in. diam., 20 in. deep. Bright orange yellow.

Nantucket. Various. 18 in. diam., 10 in. deep. Deep green.

The Canada Pumpkin is of an oblate form inclining to conic, and is deeply and regularly ribbed, and when well grown of comparatively large size. It is somewhat variable in size and shape, however, as usually seen. We think we are justified in the following synonymy:

Cucurbitæ indianæ and peregrinæ. Pin., 1561, 191.

Cucurbita indica, rotunda. Lugd., 1587, I., 616.

Pepo rotundus compressus melonis effigie. Lob. Obs., 1576, 365; ic., 1591, I., 642.

(?) *Pepo indicum minor rotundum.* Ger., 1597, 774.

[124] Kalm. Trav., 1770, ., 140, 347.
[125] Carver. Trav., 1776, 211.
[126] Woods. Illinois Country, 122.

Pepo silvestris. Dod., 1616, 668.

Melopepo. Tourn., 1719, t. 34.

Canada Pumpkin. Vermont Pumpkin.

Cheese Pumpkin. Fruit much flattened, deeply and rather regularly ribbed, broadly dishing about cavity and basin. Varies somewhat widely in the proportional breadth and diameter.

Melopepo compressus alter. Lob. ic., 1591, I., 643.

Pepo maximus compressus. Ger., 1597, 774.

Cucurbita genus, sive Melopepo compressus alter, Lobelio. J. B., 1651, II., 266.

Large Cheese. Fessenden, 1828; Bridgeman, 1832.

Cheese.

· This variety, says Burr, was extensively disseminated in the United States at the time of the American Revolution, and was introduced into New England by returning soldiers.

Common Yellow Field. Fruit rounded, a little deeper than broad, flattened at the ends, rather regularly and more or less prominently ribbed.

Cucurbita indica. Cam. Epit., 1586, 293.

Melopepo teres. Lob. ic., 1591, I., 643.

Pepo maximus rotundus. Ger., 1597, 773.

Cucurbita aspera, Icon. I. J. B., 1651, II., 218.

Cucurbita folio aspero, zucha. Chabr., 1673, 130.

Common Yellow Field Pumpkin.

Long Yellow. Fruit oval, much elongated, the length nearly or often twice the diameter, of large size, somewhat ribbed, but the markings less distinct than those of the Common Yellow.

Cucumis Turcicus. Fuch., 1542, 698.

Melopepo. Roszlin, 1550, 116.

Pepo. Tragus, 1552, 831.

Cucurbita indica longa. Lugd., 1587, I., 617.

Pepo maximus oblongus. Ger., 1597, 773.

Pepo majer oblongus. Dod., 1616, 635; Bodæus, 1644, 782.

Cuourbita aspera, Icon. II. J. B., 1651, II., 218.

Cucurbita folio aspero, zucha. Chabr., 1673, 130.

Long Yellow Field Pumpkin.

The "*Jurumu* Lusitanus *Bobora*" of Marcgravius [127] and Piso[128] would seem to belong here, except for the leaves, but the figure is a poor one.

These forms we have just mentioned have all that something in their common appearance that at once expresses a close relationship, and to the casual observer does not express differences.

We now pass to some other forms also known as pumpkins, but to which the term squash is sometimes applied.

The Nantucket Pumpkin occurs in various forms under this name, but the form I refer to, and of which I have examined specimens, belongs to *Cucurbita pepo*, Cogn. l. c., and is of an oblong form, swollen in the middle and indistinctly ribbed. It is covered more or less completely with warty protuberances, and is of a black green color when ripe, becoming mellowed toward orange in spots by keeping. It seems closely allied to the *Courge Sucriere du Bresil* of Vilmorin. It is not the *Cuucrbita verrucosa* of Dalechamp, 1587, nor of J. Bauhin, 1651, as in these figures the leaves are represented as entire, and the fruit as melon-formed and ribbed.

In 1884 there appeared in our seedsmen's catalogues, under the name of Tennessee Sweet Potato Pumpkin, a variety very distinct, of medium size, pear-shape, little ribbed, of a creamy white striped with green color, and the stem swollen and fleshy. Of its history I have ascertained nothing, but it bears a quite strong likeness in shape to a tracing of a piece of "pumpkin" pottery exhumed from the Western mounds, and sent me by Lucien Carr, connected with the museum at Cambridge, Mass. In Lobel's history, 1576, and in his plates, 1591, appear figures of a plant which in both leaf and fruit represents fairly well our variety; and these figures are of interest as being the only ones I have yet found in the ancient botanies which represents a fruit with a swollen herbaceous stem. I think I am justified in the following synonymy:

Pepo oblongus vulgatissimus. Lob. Obs., 1576, 365.

Pepo oblogus. Lobel, ic., 1591, I., 641.

Tennessee Sweet Potato Pumpkin.

127 Piso. Hist. Nat. Bras., 1648, 44.

128 Piso. De Ind., 1658, 264.

A quite numerous series of pumpkins are known to our seedsmen's catalogues, and some of a form quite distinct from those here noticed, but I have not as yet sufficiently studied these so as to form an opinion. I think, however, that much may be yet learned through the examination of quite complete sets of varieties within each of the three described species of Cucurbita which furnish fruits for our consumption. Notwithstanding the ready crossings which are so apt to occur within the ascribed species, there yet seems to exist a permanency of types which is simply marvellous, and which would seem to lend countenance in the belief that there is a need of a revision of the species, and a closer study of the various groups or types which appear to have remained constant during centuries of cultivation.

If we consider the stability of types, and the record of variations that appear in cultivated plants, and the additional fact that so far as determined the originals of cultivated types have their prototype in nature,[120] and are not the products of culture, it seems reasonable to suppose that the record of the appearance of types will throw light upon the country of their origin. From this standpoint, we may hence conclude that, as the present types have all been recorded in the Old World since the fifteenth century, and were not recorded before the fourteenth and succeeding centuries, there must be a connection between the fact of the discovery of America, and the fact of the appearance of pumpkins and squashes in Europe.

The Gourd.

The word gourd is believed to be derived from the Latin *curcurbita*, but it takes on various forms in the various European languages. It is spelled *gowrde* by Turner in 1538, *gourde* by Lobel in 1576, and *gourd* by Lyte in 1586. In France it is given as *courgen* and *cohurden* by Ruellius in 1536, but appears in its present form, *courge*, in Pinaeus, 1561. Dalechamp used *coucourde* in 1587, a name which now appears as *cougourde* in

[120] See A Study of the Dandelion. AM. NAT., Jan., 1886.
See History of Celery. AM. NAT., July, 1886.
See A Study in Agr. Botany. Proc. of the Soc. for Prom. of Agr. Sc., 1886.
See History of the Currant. Trans. of West N. Y. Hort. Soc.

Vilmorin. The Belgian name appears as *cauwoord* in Lyte, 1586; and the Spanish name, *calabassa*, with slight change of spelling, has remained constant from 1561 to 1864, as has the *zucca* of the Italians and the *kurbs* of the Germans.

The *lagenaria* is but rarely cultivated in the United States, except as an ornamental plant, and as such shares a place with the small hard-shelled cucurbita which are known as fancy gourds. In some localities, however, under the name of sugar trough gourd, a lagenaria is grown for the use of the shell of the fruit for the purposes of a pail; and what is worthy of note, this type of the fruit does not exactly appear in the drawings of the botanists of the early period, nor in the seed catalogues of Europe at the present time. In the Tupi Dictionary of Father Ruiz de Montaga,[130] 1639, among the gourd names are "iacvi-gourd, like a great dish or bowl," which may mean this form. When we examine descriptions, this gourd may be perhaps recognized in Columella's account, "Sive globosi corporis, atque utero minium quae vasta tumescit,"[131] and used for storing pitch or honey; yet a reference to his prose description [132] rather contradicts the conjecture, and leads us to believe that he only describes the necked form, and this form only seems to have been known to Palladius.[133] Pliny[134] describes two kinds, the one climbing, the other trailing. Walafridus Strabo,[135] in the ninth century, seems to describe the *plebeia* of Pliny as a curcurbita, and the cameraria as a pepo; the former apparently a necked form, and the latter one in which the neck has mostly disappeared, leaving an oval fruit. Albertus Magnus,[136] in the thirteenth century, describes the cucurbita as bearing its seed "in vase magno," which implies the necked form. The following types are illustrated in the various herbalists which I have in my library:

130 Quoted by Gray and Trumbull, *Am. Jour. of Sci.*, May, 1883, 372.
131 Columella. Lib. X., c. 383.
132 Columella. Lib. XI., c. 3.
133 Palladius. Lib. IX., c. 9.
134 Pliny. Lib. XIX., c. 24.
135 Walfridus Strabo. Hortulus in Macer Floridus, Ed. of Silling., 1832, pp. 146, 147.
136 Albertus Magnus. Jessen Ed., 1867, 500.

I. *Cucurbita oblonga.* Fuchs., 1542, 370.

Cucurbita plebeia. Roszlin, 1550, 115.

Cucurbita. Trag., 1552, 824.

Cucurbita longa. Cardanus, 1556, 222.

Cucurbita. Matth., 1558, 261; Pinaeus, 1561, 190; Cam. Epit., 1586, 292.

Cucurbita sive zuccha, omnium maxima anguina. Lob. Obs., 1576, 366; ic., 1591, I., 644.

Cucurbita cameraria longa. Lugd., 1587, I., 615.

Cucurbita anguina. Ger., 1597, 777.

Cucurbita oblonga. Matth., 1598, 392.

Cucurbita longior. Dod., 1616.

Zucca. Castor Durante, 1617, 488.

Cucurbita anguina longa. Bodaeus, 1644, 784.

Cucurbita longo, folio molli, flore albo. J. Bauh., 1651, II., 214; Chabr., 1673, 129.

Courge massue tres longue. Vilm., 1883, 190.

Club Gourd.

II. ———. Ruellius frontispiece, 1536.

Cucurbita minor. Fuch., 1542, 369.

Cucurbita. Trag., 1552, 824; Matth., 1558, 261; Cam. Epit., 1586, 292.

Cucurbita marina. Cardan, 1556, 222.

Cucurbita lagenaria. Lob. Obs., 1576, 366; ic., 1591, I., 644; Matth., 1598, 393.

Cucurbita cameraria. Lugd., 1587, I., 615.

Cucurbita lagenaria sylvestris. Ger., 1597, 779.

Cucurbita prior. Dod., 1616, 668.

Zucca. Cast. Dur., 1617, 488.

Courge pelerine. Vilm., 1883, 191.

Bottle Gourd.

III. *Cucurbita calebasse.* Tourn., 1719, t. 36.

Courge siphon. Vilm., 1883, 190.

Dipper Gourd.

IV. *Cucurbita major.* Fuchs., 1542, 368.

Cucurbita cameraria. Roszlin, 1550, 115.

Cucurbita. Tragus, 1552, 824; Matth., 1358, 261.

Cucurbita cameraria major. Lugd., 1587, I., 616.

Cucurbita lagenaria. Ger., 1597, 777.

Cucurbita major sessilis. Matth., 1598, 393.

Cucurbita lagenaria rotunda. Bodaeus, 1644, 784.

Cucurbita latior, folio molli, flore albo. J. Bauh., 1651, I., 215; Chabr., 1673, 129.

Sugar Trough Gourd.

V. *Cucurbita.* Matth., 1558, 261; Lugd., 1587, I., 615.

Courge plate de corse. Vilm., 1883, 191.

This classification, it is to be remarked, is not intended for exact synonymy, but to represent the like types of fruit-form. Within these classes there is a wide variation in size and proportion.

Whether these lagenaria existed in the new world before the discovery by Columbus, as great an investigator as Gray [137] considers as worthy of examination, and quotes Oviedo for the period about 1526, as noting the long and round or banded, and of all the shapes they usually have in Spain, as much used in the West Indies and Terra Firma for carrying water, and indicates that there are varieties of spontaneous growth as well as those under cultivation. The occurrence, however, of the so-called fancy gourds of the *Cucurbita pepo* species, of hard rind, of gourd shape, and often of gourd bitterness, renders difficult the identification of species through the uses. The relation of the voyage of Amerigo Vespucci,[138] 1489, mentions the Indians of Trinidad and of the coast of Paria as carrying about their necks small dried gourds filled with the plant they are accustomed to chew, or with a certain whitish flour; but these records might as well be made from the *Cucurbita pepo* gourds as from the lagenaria gourds. The further mention that each woman carried a cucurbita of water might seem to refer to gourds. Acosta [139] speaks of the Indians of Peru making floats of gourds, for swimming, and says: "There are a thousand kinds of Calebasses; some are so deformed in their bigness that of the rind cut in the

[137] Gray and Trumbull. *Am. Jour. of Sci.*, May, 1883, 370.

[138] Quoted from Gray and Trumbull, l. c.

[139] Acosta. Hist. of Indies, Eng. Ed., 1604, 177, 238.

midst and cleansed, they make as it were, baskets to put in all their meat, for their dinner ; of the lesser, they make vessels to eat and drink in," etc. Bodaeus'[140] quotation, in Latin, reads differently in a free translation : "They grow in the province of Chili to a wonderful size, and are called *capallas*. They are of an indefinite number of kinds; some are monstrous in their immense size, and when cut open and cleaned, furnish various vessels. Of the smaller they most ingeniously make cups and saucers." In 1624 Bodaeus received from the West Indies some seed which bore fruit "quae humanum crassitudinem and longitudanem superaret," which fully justifies Acosta's idea of size. The Anonymous Portugal of Brasil[141] says: "Some pompions so big that they use them for vessels to carry water, and they hold two pecks or more." Baro[142] in 1647 also speaks of "Courges and calebasses si grandes and profondes qu'elles servent comme de magazin," and Laet[143] mentions "Pepones tam vastae, ut Indigenae iis utantur pro vasis quibus aquam aggerunt." These large-sized gourds were not, however, confined to America. Bodaeus, as we have noted, grew fruits deformed in their bigness, to use Acosta's term, from West Indian seed, and Cardanus[144] says he has seen gourds (for he gives a figure which is a gourd) weighing 80 and 122 lbs.; Bauhin[145] records the club gourd as sometimes three feet long, Ray[146] as five or six feet long, and Forskal[147] the bottle gourd as 18 inches in diameter. These records of size are all, however, of a date following the discovery of America, and the seed of these large varieties might have come from American sources, as is recorded in one case by Bodaeus.

The gourd is of old world origin, for water-flasks of the lagenaria have been found in Egyptian tombs of the twelfth

140 Bodaeus a Stapel. Theophrastus, 1644, 784.

141 Anonymous Portugal of Brasil. Purchas, Lib. 7, c. I., p. 1310. Quoted from Sloane's Cat., 1696, 100.

142 Baro in Morisot, p. 294. Quoted from Sloane's Cat., 1696, 100.

143 Laet, Lib. 15, c. 10, p. 566. Quoted from Sloane's Cat., 1696, 100.

144 Cardanus. De Rerum Varietate, 1556, 222.

145 Bauhin. Pin., 1623, 313.

146 Ray. Hist., 1686, I., 638.

147 Forskal. Fl. Ægypt—Arab., 1775, 167.

dynasty, or 2200 to 2400 years B.C.,[148] and they are described by the ancient writers. That the gourd reached America at an early period, perhaps preceding the discovery,[149] we cannot doubt, for Marcgravius notes a cucurbit with a white flower, and of lagenarian form, in Brazil in 1648;[150] but there is not sufficient evidence, so it seems to us, to establish its appearance in America before brought by the colonists. What the calabazas were which served for water-vessels, and were apparently of considerable size, we can at present but surmise. It is possible that there are varieties of *Cucurbita pepo* not yet introduced to notice that would answer the conditions. It is also less possible that gourd-shaped clay vessels might have been used, and thus recorded by not over-careful narrators as gourds. In 1595, Mendana, on his voyage to the Solomon Islands, saw "Spanish pumpkins"[151] at the islands of Dominica and Santa Cruz, or according to another translation,[152] "pumpkins of Castille." It would seem by this reference that, whether the "calabaza" of the original Spanish referred to gourds or pumpkins, it did not take many years for this noticeable class of fruits to receive a wide distribution, and it might further imply that Mendana, setting forth from the western coast of America, discriminated between the American pumpkin, or pumpkin proper, and the Spanish pumpkin or gourd.

[148] Schweinfurth. *Nature*, Jan. 31, 1883, 314.

[149] Fruits of the lagenaria are at present carried to the coast of Iceland by ocean currents.

[150] Piso. Hist. Nat. Bras., 1648, 44.

[151] Mendana. Dalyrmple, Voy., I., 72, 88.

[152] De Morga. Phillipine Is., Hak. Soc., Ed. 68, 70.

THE NOTES OF SOME OF OUR BIRDS.

BY JOHN VANCE CHENEY.

RED-EYED VIREO.

THIS lively, tireless singer, running rapidly after insects in the tops of the forest trees, singing as he goes, is heard more hours in a day and more days in the season than any other bird. There is no difficulty in distinguishing him,—the bird so easy to hear and so hard to see. The clear, high tones of his rich voice are a constant repetition of a few triplets, but so ingeniously arranged as not to become wearisome:

This illustration, containing the substance of the red-eyed vireo's song, has much in common with the music of other birds. The nest is after the fashion of the oriole's, hanging, as I have found it, beneath the fork of small beech limbs, five or six feet from the ground. It is a nice little pocket, as the cow-bird well knows.

INDIGO BIRD.

I had very little acquaintance with this bird, and knew nothing of his singing, till I sought him for study in a sunny nook near the entrance of the beautiful cemetery at Lynn. There a pair spent the season, giving me frequent opportunities to listen to the singer. His song was brief, plain, and without variation, and I supposed it to be the family song; but, to my surprise, though I have heard indigo birds sing many times since, not one of them sang that first song, the only one I have been able to copy.

The exact tones were:

At first the tonic was not quite distinct, but, after several performances, I caught this:

The conclusion, then, was that the key was F. In the repetitions the last two tones were added about one time in six; just often enough to keep in mind the true key, which, by the constant use of sharp 4, might be lost sight of.

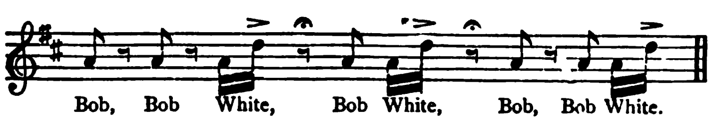
The form, then, was as follows:

This little visitor sang frequently and earnestly; with most fervor in the hot noon-day sun, when the birds generally were silent.

PARTRIDGE.

The partridge is said to be a general inhabitant of North America, but, familiar as I have been with almost all parts of Vermont for more than thirty years, I have only seen one quail in the state, and he was evidently a "tramp." I heard him just at night, the first day of July, 1884. Did not get sight of him till the next morning, when he came out into the sun, stood on the top rail of a fence, warmed himself, and whistled his spirited, forceful tune, his solid little body swelling and throbbing at every note, especially when he rose to the tonic.

I was prepared for him, and made an exact copy of what he gave me:



After the performance he stood, evidently listening for a reply; none came, and, without another note, he disappeared, to be seen no more.

The partridge is about one-half the size of our grouse, and resembles it in plumage and style of flight. It seems a little strange that the time of incubation should be four weeks, while the grouse and the domestic hen sit only three weeks. A nest that I found in Iowa in 1874—on the ground—seemed rather small and too deep, the sixteen eggs being piled one upon another for three layers, at least. I was told that they were all sure to hatch.

Our eastern partridge are plump, fine-looking birds, but there are two varieties in California, the "mountain" and the "valley partridge," more beautiful than ours.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

FICTION and the newspapers form the staple of the reading of the American people. Serious books which treat of matters of fact have fewer readers; and exact or scientific books fewer still. In the estimation of some people this is an unfavorable state of affairs, and speaks ill for our intellectual condition. We take a somewhat different view of it. The newspapers treat mainly of matters of fact, and they are only worthy of complaint when they give undue prominence to trivial matters, and to the evil that men do, and not enough to those events which make for human development and progress. This criticism may be justly applied to many newspapers. Also there is fiction and fiction. A class of French fiction, which has imitators in other countries, on pretence of being "realistic," is evil and only evil, and should be, in our estimation, like the "Kreutzer Sonata" of Tolstoi, excluded from the mails. But much fiction is instructive, both in the facts of human character and in those of nature, and is of great utility as conveying much truth, sugar-coated, to the unsuspecting reader. Besides, were fiction abolished the number

of readers would be greatly diminished. Fiction, in fact, is the pioneer of the intellectual life, and many persons, more's the pity, never get beyond it. Without it, they would never get so far. But many readers of fiction do better. Interest in a thousand subjects is suggested, especially history, biography, geography, metaphysics, social science, and what not. Some who begin by scoffing at science remain to pray at her shrine. And it is quite possible that society will ere long have a surfeit of fiction. Froth and sponge serve as an inflator of the mental stomach for a time, but they are apt to generate a taste for something more solid as time passes on. In fact, mankind at large will, ere long, begin to suspect that the raw material of reality out of which the frail structures of fiction are built, must be of as much interest as are its products. On a little inspection thcy will find that truth is really stranger than fiction, as has been often said, and that there is an inexhaustible supply of it. From being readers of Balzac and Zola, they will become subscribers to and readers of the AMERICAN NATURALIST.

RECENT BOOKS AND PAMPHLETS.

ADLERZ, G.—Our Digestionssekretionem hos Insekter och Myriopoder. Bihang. Till K. Svenska Vet. Akad. Handlingar, Band 16, 1890.

ALLEN, I. A.—On the Maximilian Types of S. A. Birds. Ext. Am. Mus. Nat Hist. N. Y., 1889.

BAUR, G.—Revision meiner Mittheilungen im *Zoologischen Anzeiger* mit Nachträgen. Separat-Abdruck aus dem *Zoologischen Anzeiger*, No. 306, 1889. Osteologische Notizen über Reptilien. Separat-Abdruck *Zoologischen Anzeiger*, No. 298, 1889.—Die Systematische Stellung von Dermochelys Blainv. Sonderabdruck aus dem Biologischen Centralblatt, Band IV., 1889. From the author.

BEAN, T. H.—Description of a new Cottoid Fish collected by the U. S. Fish Com. Ext. Proc. U. S. Nat. Mus., Vol. XII., 1890.

———. Notes on Fishes Collected at Cozumel, Yucatan, by U. S. Fish Commission, with Descriptions of New Species. Ex. from Bull. U. S. Fish Commission, Vol. VIII. From the author.

BECKER, G. F.—Silicic Acids. Ext. *Am. Jour. Sci.*, Vol. XXXVIII., 1889. From the author.

BOETTGER, O.—Die Entwicklung der Pupa-Arten des Mittelrheingebiets in Zeit und Raum. Separat-Abdruck aus den Jahrbüchen des Nassauischen Vereins für Naturkunde, Jahrgang 42, 1889.

BOGNE, E. A.—A Study of the Visible Changes that take place during the Development of Human Teeth and their Alveoli. Ext. Dental Cosmos, 1889. From J. M. White.

BRIDGE, T. W.—The Air-Bladder and Weberian Ossicles in the Siluridæ. Ext. Proc. Roy. Soc., Vol. XLVI. From the author.

BRINTON, D. G.—Aims and Traits of World-Language. Ext. *Werner's Voice Mag.* From the author.

BROWN, H. P.—The Commercial Efficiency of the Leading Systems of Electric Lighting.

Bull. No. 9, 1889, Experiment Station, Kansas Agricultural College.

Bull. No. 20, U. S. Department Agriculture. The Root-Knot Disease of the Peach, Orange, and Other Plants in Florida. From J. M. Rusk.

BUSH, G. G.—History of Education in Florida. Bureau of Education, Cir. of Inf. No. 7, 1888.

Contributions to American Educational History, Nos. 2, 4, 5, and 7.

Constitution of the Geological Society America. From J. J. Stevenson.

CRAGIN, F. W.—Contributions to the Geology of the Plains. No. 1. Extract Bull. Washburn College Lab. Nat. Hist., Vol. II., 1889.

CREDNER, H.—Die Stegocephalen und Saurier aus dem Rothliegenden des Plauenischen Grundes bei Dresden. Besonderer Abdruck aus der *Zeitschrift der deutschen geologischen Gesellschaft*, Bd. XLI., 1889. From the author.

DAWSON, I. W.—New Species of Fossil Sponges from the Siluro-Cambrian at Little Metis. Trans. Roy. Soc. Can., Vol. VII., 1889.

———. Notes on the Cretaceous of the British Columbian Region—The Nanaimo Group. Extract *Am. Jour. Sci.*, Vol. XXXIX., 1890.

———. On the Earlier Cretaceous Rocks of the Northwestern Portion of the Dominion of Canada. Extract *Am. Jour. Sci.*, Vol. XXXVIII., 1889.—Glaciation of British Columbia. Extract *Geol. Mag.*, 1889.

DAWSON, W., AND D. P. PENHALLOW.—On the Pleistocene Flora of Canada. Bull. Geol. Soc. Am., Vol. I., pp. 311–334.

Declaration of Principles of the Society of Individualists, 1890.

DOEDERLEIN, L.—Bericht über die Zoologische Abtheilung des Museums für Jahre 1886 bis 1889. Naturhistorisches Museum der Stadt Strassburg.

ECCLES, R. G.—Evolution of the Mind. *Modern Science Essayist*, Vol. I., 1889 From the author.

EIGENMANN, C. H., and R. S. EIGENMANN.—Additions to the Fauna of San Diego. Ext. Proc. Cal. Acad. Sciences, Vol. III.

———. Description of a New Species of Cyprinodon.—A Review of the Erythrininæ. Ext. Cal. Acad. Sci., 1880.

———. A Revision of the Edutulous Genera of Curimatinæ. Ext. Ann. N. Y. Acad. Sci., Vol. IV.

———. Notes on some California Fishes, with Descriptions of two New Species. Ext. Proc. U. S. Nat. Mus., 1888.

———. Notes from the San Diego Biological Laboratory. The Fishes of Cortez Banks.

———. Preliminary Notes on South American Nematognathi. Ext. Proc. Cal. Acad. Sci., 2d Ser., II. From the authors.

Evolution.—Popular Lectures and Discussions before the Brooklyn Ethical Association, 1889. From James H. West, publisher.

FEWKES, J. W.—Statement of Plans for the Establishment of a Fresh-Water Aquarium and Zoological Garden at Boston, 1889.

FÜRBRINGER, M.—Über die Stellung von Stringops, der Papageien, und von *Jynx*.

HAYNES, H. W.—The Prehistoric Archæology of North Am. Chap. VI., Vol. I., of Narrative and Critical Hist. of Am., edited by Justin Winsor. From the author.

HADDEN, A. C.—A Revision of the British Actiniæ, Part I. Trans. Roy. Dub. Soc., Vol. IV., 1889.

HEAD, F H.—Shakespeare's Insomnia. From the author.

HECTOR, J.—On the Fossil Reptilia of New Zealand. Ext. Proc. Wellington Philos. Soc., 1873. From the author.

HILL, R. T.—Relation of the Uppermost Cretaceous Beds of the Eastern and Southern U. S. Ext. *Am. Jour. Sci.*, Vol. XXXVIII., 1889.

HORN, G. H.—Reply to C. V. Riley on Platypsyllus.

HOWES, G. B.—Additional Observations upon the Intranarial Epiglottis. Ext. *Jour. Anat. and Physiol*, Vol. XXIII. From the author.

JONES, C. E.—Education in Georgia. Circulation of Information, No. 4, Bureau of Education.

KALOUSEK, J.—Die Königlich Böhmische Gesellschaft der Wissenschaften in Prag. Jahresbericht der Königl. Böhm. Geschellschaft der Wissenschaften für das Jahr., 1889.

KEISER, E. H.—On the Combustion of Weighed Quantities of Hydrogen, and the Atomic Weight of Oxygen. Ext. *Am. Chem. Jour.*, Vol. X. From the author.

LAWRENCE, G. N.—A New Name for the Species of Sporophila from Texas. Ext. *Auk*, Vol. VI.—Description of a New Species of Wren from Tobago, W. Ind. Ext. *Auk*, Vol. V.—Description of a New Species of Bird of the Genus Catharus, from Ecuador. Proc. U. S. Nat. Mus., 1887.

LANGLEY, S. P.—Report of the Smithsonian Institution for the year ending June 30, 1889.

LEBOUCQ, H.—De la Soudure Congénital de Certains os du Tarse. Ext. Bull. d l'Acad. Royal de Médecine de Bruxelles, 1890.

Über Nagelrudimente au der Fötalen Flosse der Cetacean und Sirenier. Sonder-Abdruck aus *Anatomischer Anzeiger*, IV., Jahrgang, 1889. From the author.

LECHE, W.—Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs Wissenschaftlich Dargestellt in Wort und Bild. Sechster Band. V. Abtheilung.

LIDTH DE JEUDE, TH. W. VON.—On a Collection of Snakes from Delhi. Ext. Notes Leyden Mus., Vol. XII. From the author.

List Publications Johns Hopkins University.

Macalester College Contributions, No. 6. Notice of a Rare Washington Portrait; also Descriptions of Some Copper Relics of the T. H. Lewis Collection.

MALLERY, G.—Israelite and Indian. Ext. *Pop. Sci. Monthly*, 1889. From the author.

MERRIAM, G. H.—Revision of the North American Pocket Mice.—Descriptions of Fourteen New Species and One New Genus of A. Amer. Mammals. North Am. Fauna, No. 1. From U. S. Dept. Agri.

MILLER, S. A.—North American Geology and Palæontology. From the author.

MOURLON, M.—Sur le Gisement des Silex Taillés Attribuér à l'Homme Tertiare, aux Environs de Mons. Ext. Bull. de l'Acad. Roy. de Belgique, Tome XVII., 1889. From the author.

MONTGOMERY, E.—Mental Activity. Ext. *Mind*, Vol. XIV.

MORGAN, A.—The Society and the "Fad." Fact and Theory Papers No. 11. From the author.

MYSTRÖM, E.—Om en Monstros Form af *Cottus scorpius* Lin. Bihang Till K. Svenska Vet. Akad. Handlingar, Band 14, 1889.

NEWBERRY, J. S.—Sketch of Pres. F. A. P. Barnard, LL.D., S.T.D., L.H.D. Reprint from Necrology Report of the University Convocation of the State of New York July 9–11, 1889.

———. The Oil-Field of Colorado. Ext. *School of Mines Quarterly*, Vol. X., No. 2, Jan., 1889.

———. The Laramie Group.—The Rock Salt Deposits of the Salina Group in Western N. Y. Exts. Trans. N. Y. Acad. Sci., Vol. IX.

———. Fossil Fishes and Fossil Plants of the Triassic Rocks of New Jersey and the Connecticut Valley. Monograph U. S. Geol. Survey, Vol. XIV.

———. The Paleozoic Fishes of North America. Monograph U. S. Geol. Survey, Vol. XVI. From the author.

PALMER, C. T.—Artificial Persons: A Philosophical View of the Law of Corporations. Extract *Open Court*, 1888. From Dr. P. Carus.

POHLIG, H.—Dentition and Kranologie des *Elephas antiquus* mit Beiträgen über *Elephas primigenius* Blum. und *Elephas meridionalis* Nesti. Nova Acta der Ksl. Sedf. Carol. Akad. der Naturforscher, Band LIII.

Prevention of Swine Plague by Inoculation. From F. S. Billings & Co.

Report Arkansas Geol. Survey, 1888.

Report Brooklyn Ethical Association, 1888–'89.

Report of the Curator Harvard Mus. Comp. Zool., 1888–'89.

Report of the California State Mineralogist for the year ending Oct. 1, 1888.

Report of the Germantown Science and Art Club at the Tenth Anniversary, 1890.

Reports of Sub-Committees of the International Congress on Classification and Nomenclature.

Report of the Trustees of the Australian Museum for 1889.

RENEVIER, E.—Philippe de la Harpe, Sa Vie, et ses Travaux Scientifiques. Tiré du Bull. Soc. Vaud. Sc. Nat., Vol. XXV. From the author.

ROTH, S.—Catalogue No. 5. Fossiles de la Pampa Amérique du Sud.-Avis.

SHUFELDT, R. W.—Remarks upon Extinct Mammals.

———. Observations upon the Osteology of the Orders Tubinares and Steganopodes. Ext. Proc. U. S. Nat. Mus, Vol. XI., 1889.—Osteological Studies of the Sub-Family Ardeinæ. Ext. *Journal Comp. Med. and Surg.*, 1889.

———. Observations upon the Osteology of the Larus and Grebes. Ext. *Journal Anat. and Phy.*, Vol. XXIV.

———. On the Position of Chamæa in the System. Reprint *Journal Morph.*, Vol. III., No. 3. From the author.

Sketch of the Laboratory of Biological Research of the Brooklyn Institute.

SMITH, C. L.—History of Education in North Carolina. Bureau of Ed., Cir. of Inf. No. 2, 1888.

STEFANESCU, G.—Mémoire Relatif à la Geologie du Judet del Doljin. Annarulŭ Biurouliu Geologicŭ, 1882–'83, No. 4.

TAVEL, F. VON—Contributions to the History of the Development of Pyrenomycetes. Ext. *Journal Mycology*, 1889. From J. M. Rusk.

RECENT LITERATURE.

Eimer on Evolution.[1]—This work reaches the scientific men of English-speaking countries at a time when the views of Weismann are being read, and it serves as a source of evidence on the opposite side of the interesting question which they discuss. Professor Eimer has taken a broader view of the field than is done by that large class of biologists whose knowledge is limited by the use of the microscope, and he is therefore in possession of a class of facts which are apt to

[1] Organic Evolution as the Result of the Inheritance of Acquired Characters, According to the Law of Organic Growth, by G. H. Theodor Eimer, Professor of Zoology and Comparative Anatomy at the University of Tübingen. Translated by I. H. Cunningham, M.A., F.R.S.E. London: MacMillan & Co., and New York, 1890. 8vo, pp. 435.

escape the researches of the histologists and embryologists. While using the many important and essential facts brought to light by the latter class of investigators, he has not neglected researches which do not require the mechanical appliances which give a somewhat factitious value to the pursuits of microscopy and telescopy. Prof. Eimer is already well known through his important investigations on the distribution and origin of color-markings in insects and reptiles; his discussion of the variations of the wall lizard of Europe (*Lacerta muralis*) being a model of this kind of work. From these and similar researches on the variations in the colors of caterpillars, and imagines of various Lepidoptera, he has shown conclusively that *color-variations are not promiscuous or fortuitous, but follow certain definite directions.* This result is in entire harmony with those derived from similar studies which I have made on the coloration of certain snakes, and of which I have published, especially the case of the North American *Ophibolus doliatus.*[2] The author then proceeds to discuss the effects of physical agencies as causes of variations, as light, temperature, humidity, etc. Of the effects of use and disuse he says (p. 153): "It is a self-evident physiological fact that practice or use strengthens and improves the organs of the body, while disuse causes them to deteriorate." He then adds: "That characters acquired through use or disuse are inherited, and must therefore aid in the formation of new species, can be proved more easily than any of the propositions I am maintaining. If I were to bring together all the facts which could be used as evidence on this point, I should never come to the end of them, for I should have to refer to all the facts of anatomy and physiology. But I intend to show in particular that use and disuse by themselves must lead to the formation of new permanent characters, without the aid of selection, for even this I hold to be a physiological necessity." Accordingly, the author cites many facts in support of this view. Among these he relates some interesting cases of the inheritance of mutilations and abnormalities.

Considerable space is devoted to the question of the origin and transmission of mental characteristics, and here especially Prof. Eimer shows himself an acute observer and thinker. His residence has grounds attached to it, where he has been accustomed to have under his eye animals both domestic and wild, and his observations on the habits of these are highly interesting. He coincides in opinion with most observers on this subject, that mental habits are readily transmitted by inheritance, and his observations on young chickens and other birds are very instructive.

[2] Proceeds, U. S. National Museum, 1888, p. 381. Bulletin do., I. 1875, p. 3.

Prof. Eimer takes occasion frequently to criticise the opinions of Prof. Weismann. The following is a sample of this polemic :

"In the paper previously mentioned, 'Retrogression in Nature,' Weismann replies with greater detail and precision than on previous occasions to the objections which may be made—as they have been made by me—to his theory on account of the facts of the degeneration of organs in consequence of disuse.

"Starting from the proposition that 'the adaptation of living beings, in all their parts, depends on the process of natural selection,' he infers that this adaptation must be maintained by the same means by which it was produced, and that it must again disappear as soon as this means, natural selection, fails to act.

"In other words, he says: Through natural selection alone forms have come to be what they are. By the continuation of natural selection only are they maintained in their present state. If selection ceases, they of necessity retrograde. But selection with respect to a particular organ obviously ceases as soon as that organ is no longer necessary ('the reverse side of natural selection'); its cessation, therefore, produces the degeneration of organs.

"It is, according to my view, self-evident that the cessation of natural selection can as little cause the retrogression of an organ as natural selection can cause it to develop. Selection is, I must ever repeat, no physiological factor which could produce any thing new, or whose cessation could annul anything existing. Organs are produced by external stimuli, or by use acting upon the material given in a given case, with the aid of general and of sexual selection."

In this position the author is in entire harmony with the views of the Neo-Lamarkian school in America and England; and he supports it with an array of facts which fill a great part of the 435 pages which comprise the volume. We regret that he has not been apparently acquainted with the opinions entertained by his co-workers on this side of the Atlantic, as he might have derived some facts of use to him. To paleontology, that mine of evidence for the evolutionist, he makes but little reference; and, in fact, this subject has not been within the scope of his researches, which have been so abundant in other directions.

With respect to the cause of variations, he adduces the following example:

"Oscar Schmidt points out further that numerous [other] cases in sponges have been described by Haeckel and himself, in which the organisms are beginning to change into new species by the disappear-

ance of certain forms of skeletal structures. And I am able to add that in the markings of animals—*e.g.*, butterflies—characters everywhere degenerate whose present or former use cannot be discerned, which we must regard as non-essential.

"Weismann supposes that even in those cases in which adaptation is not demonstrated it is really present. But such an assumption belongs to the domain of faith.

"We ought, on the contrary, to say: We know that definite stimuli must produce an effect on or in the organism; that they must give rise to definite changes of form, definite character, whether these be useful to the organism or not.

"When we maintain this we take our stand, not on mere assumptions, but on physiological facts. Normal physiology and pathology in like measure speak for us with the weight of all their fundamental truths.

"Thus there is certainly a physiological basis for the belief that the above-described variations of the sponge-skeleton are simply to be ascribed to changes of external, *i.e.*, of nutritive conditions, of the material composition of the body."

The translator has performed an excellent service. We cannot but agree with him in some remarks in his preface as to the editorial conduct of the English periodical *Nature*. He complains of the exclusion of articles which do not coincide with the views of the editor of the department of Natural History. On this we observe that such exclusions, no doubt, often occur, but though it may not be commended as judicial, it is within editorial right. But mutilation or alteration of articles, as is sometimes practiced by that periodical, is clearly not within editorial right, and to this practice exception may be still more fairly taken.—*E. D. Cope.*

Geddes and Thompson on the Evolution of Sex.[1]—In this book we have a systematic *résumé* of what is known on the subject of sex, with inferences which appear to the authors reasonably to flow from the facts. The work is divided into four "books," viz.: I. Male and Female; II. Analysis of Sex,—organs, tissues, cells; III. Processes of Reproduction; IV. Theory of Reproduction. The work done in this direction has been very large in the last few years, and the time was ripe for the presentation to the public of just such a work as the present. The subject is not only intrinsically interesting, but it has the closest relation to the general question of

[1] The Evolution of Sex. By Prof. Patrick Geddes and J. Arthur Thompson. 8vo, pp. 322. From the Contemporary Science Series. London: Walter Scott.

evolution. Further, the essential nature of sex-character has the greatest practical bearing on human affairs, and its thorough comprehension cannot fail to be of great utility to society. In fact, such knowledge is the one thing needful to regulate the unbridled fancies of the uneducated mind which attempts to deal with the subject, and which has produced innumerable absurdities since the human imagination began to be active.

The authors have produced a book which has not only scientific but literary merits, and many of its bright passages indicate the artist as well as the thinker. The more delicate parts of the subject are handled with a tact that cannot give offence to persons of most opposite views, ; and a judicious reserve is maintained in the presence of unsolved social problems, with the discussion of which the volume closes.

The fundamental character of sex-diversity is demonstrated, and is traced in the characteristic peculiarities of the germ-cells of the sexes, as at present existing. The superior activity of the male cell (spermatozoöid), with its expenditure of energy in segmentation so long as material for its nutrition is accessible, is taken as reflected into the male character generally. The large, inactive female cell (ovum), abounding in nutritive material, which is ready for active functioning on the accession of male energy, is thought to be reflected more or less in the general habit of the female. The facts in evidence which sustain this position are as numerous as are the phenomena of life, and a large number of them are recorded in the present work. The views of the authors are more expressly stated in the following extracts:

"Without multiplying instances, a review of the animal kingdom, or a perusal of Darwin's pages, will amply confirm the conclusion that on an average the females incline to passivity, the males to activity. In higher animals it is true that the contrast shows rather in many little ways than in any one striking difference of of habit, but even in the human species the contrast is recognized. Every one will admit that strenuous, spasmodic bursts of activity characterizes men, especially in youth, and among the less civilized races; while patient continuance, with less violent expenditure of energy, is as generally associated with the work of women.

"For completeness of argument two other facts, which will afterwards claim full discussion, may here be simply mentioned: (*a*). At the very threshold of sex-differences we find that a little active cell or spore, unable to develop of itself, unites in fatigue with a larger, more quiescent individual. Here, at the very first, is the contrast between

male and female. (*b*). The same anthithesis is seen when we contrast, as we shall afterwards do in detail, the actively motile, minute male element of most animals and many plants with the larger, passively quiescent female cell or ovum.

"While it is easy to point to the general physiological import of large size and the reverse, physiology is not yet far enough advanced to afford firm foot-hold in dealing with the details of secondary sexual characters. It is only possible to point out the path which will eventually lead us to their complete rationale. This path will appear less vague if reverted to after some of the succeeding chapters have been grasped. The point of view is simple enough. The agility of males is not a special adaptation to enable that sex to exercise its functions with relation to the other, but is a natural characteristic of the constitutional activity of maleness; and the small size of many male fishes is not an advantage at all, but simply again the result of the contrast between the more vegetative growth of the female, and the costly activity of the male. So, brilliancy of color, exuberance of hair and feathers, activity of scent-glands, and even the development of weapons, are not, and cannot be (except teleologically), explained by natural selection, but in origin and continued development are outcrops of a male as opposed to a female constitution. To sum up the position in a paradox, all secondary sexual characters are at bottom primary, and are expressions of the same general habit of body (or to use a medical term, *diathesis*), as that which results in the production of male elements in the one case, or female elements in the other.

"Three well-known facts must be recalled to the reader's mind at this point; and firstly, that in a great number of cases the secondary sexual characters make their appearance step by step with sexual maturity itself. When the animal, be it bird or insect, becomes emphatically masculine, then it is that these minor out-crops are exhibited. Thus the male bird of paradise, eventually so resplendent, is usually in its youth comparatively dull and female-like in its coloring and plumage. Very often, too, whether in the wedding-robes of male fishes or in the scent-glands of mammals, the character rises and wanes in the same rhythm as that of the reproductive periods. It is impossible not to regard at least many of the secondary sexual characters as part and parcel of the sexual diathesis,—as expressions, for the most part of exuberant maleness. Secondly, when the reproductive organs are removed by castration, the secondary characters tend to remain undeveloped. Thus, as Darwin notes, stags never renew their antlers after castration, though normally of course they renew them each

breeding season. The reindeer, where the horns occur on the female as well, is an interesting exception to the rule, for after castration the male still renews the growth. This, however, merely indicates that the originally sexual characters have become organized into the general life of the body. In sheep, antelopes, oxen, etc., castration modifies or reduces the horns; and the same is true of odoriferous glands. The parasitic Crustacean Sacculina has been shown by Delage to effect a partial castration of the crabs to which it fixes itself, and the same has been observed by Giard in other cases. In two such cases an approximation to the female form of appendage has been observed. Lastly, in aged females, which have ceased to be functional in reproduction, the minor peculiarities of their sex often disappear, and they become liker males, both in structure and habits,—witness the familiar case of 'crowing hens.'

"From the presupposition, then, of the intimate connection between the sexuality and the secondary characters (which is indeed everywhere allowed), it is possible to advance a step further. Thus in regard to color, that the male is usually brighter than the female is an acknowledged fact. But pigments of many kinds are physiologically regarded as of the nature of waste products. Such, for instance, is the guanin, so abundant on the skin of fishes and some other animals. Abundance of such pigments, and richness of variety in related series, point to preëminent activity of chemical processes in the animals that possess them. Technically expressed, abundant pigments are expressions of intense metabolism. But predominant activity has been already seen to be characteristic of the male sex; these bright colors, then, are often natural to maleness. In a literal sense animals put on beauty for ashes, and the males more so because they are males, and not primarily for any other reason whatever.

"We are well aware that, in spite of the researches of Krukenberg, Sorby, MacMunn, and others, our knowledge of the pigments is still very scanty. Yet in many cases, alike among plants and animals, pigments are expressions of disruptive processes, and are of the nature of waste products, and this general fact is at present sufficient for our contention, that bright coloring or rich pigmenting is commonly a natural expression of the male constitution. For the red pigment so abundant in the female cochineal insect, which appears to be of the nature of a reserve and not a waste product, and for similar occurrences, due exception must be made.

"In the same way, the skin-eruptions of male fishes at the spawning season seem more pathological than decorative, and may be directly

connected with sexual excitement. One instance of a way in which the reproductive maturity is known to effect a by no means obviously related result may be given. Every field-naturalist knows that the male stickleback builds a nest among the weeds, and that he weaves the material together by mucous threads secreted by the kidneys. The little animal is also known to have strong passions; it is polygamous in relation to its mates, and most pugnacious in relation to its rivals. Professor Möbius has shown that the male reproductive organs (or testes) become very large at the breeding season, and that they press in an abnormal way upon the kidneys. This encroachment produces a pathological condition in the kidneys, and the result is the formation of a mucous secretion, somewhat similar to what occurs in renal disease in higher forms. To free itself from the irritant pressure of this secretion the male rubs itself against external objects, most conveniently upon its nest. Thus the curious weaving instinct does not demand nor find rationale in the cumulative action of natural selection upon an inexplicable variation, but is traced back to a pathological and mechanical origin in the emphatic maleness of the organism. The line of variation being thus given, it is of course conceivable that natural selection may have accelerated it.

"So, too, though again the physiological details are scanty, the superabundant growth of hair and feathers may be interpreted, in some measure, through getting rid of waste products, for we shall see later how local katabolism favors cell multiplication. Combs, wattles, and skin excresences point to a predominance of circulation in the skin of the feverish males, whose temperatures are known in some cases to be decidedly higher than those of females. Even skeletal weapons like antlers may be similarly interpreted; while the exaggerated activity of the scent-glands is another expedient for excreting waste.

"In regard to horns, feathers, and the like, in association with vigorous circulation, two sentences from Rolph may be quoted: 'The exceedingly abundant circulation which periodically occurs in the at first soft frontal protuberances of stags admits and conditions the colossal development of horn and ensheathing velvet. . . . In the same way the rich flow of blood in the feather papillæ conditions the immense growth of the feathers, . . . and the same is true of hairs, spines, and teeth.'

"Some of the even subtler differences between the sexes are of interest in illustrating the general antithesis. Thus in the love-lights of the Italian glow insect (Luciola) the color is said to be identical in the

two sexes, and the intensity is much the same. That of the female, however, who is in other respects rather male-like in her amatory emotions, is more restricted. It is interesting further to notice that the rhythm of the light in the male is more rapid, and the flashes are briefer, while that of the female is longer, and the flashes more distant and tremulous. This illustration may thus serve, in conclusion, as a literally illumined index of the contrasted physiology of the sexes.

"We are now in a better position to criticize Mr. Darwin's theory. On his view, males are stronger, handsomer, or more emotional, because ancestral forms happened to become so in a slight degree. In other words, the reward of breeding success gradually perpetuated and perfected a casual advantage. According to the present view, males are stronger, handsomer, or more emotional, simply because they are males,—*i. e.*, of more active physiological habit than their mates. In phraseology which will presently become more intelligible and concrete, the males live at a loss, are more *katabolic*,—disruptive changes tending to predominate in the sum of changes in their living matter or protoplasm. The females, on the other hand, live at a profit, are more *anabolic*,—constructive processes predominating in their life, whence, indeed, the capacity of bearing offspring."

Thus it is evident that the authors of the present work hold the tenets of the Neo-Lamarkians in maintaining the direct influence of physical causes as producing variation, and in the belief that acquired characters are inherited. The reasons for the adoption of these views are often stated, and with a good deal of force. The reasons why promiscuous variation and natural selection are inadequate to explain evolution, are also clearly set forth.

In the last chapter the question of population raised by Malthus is considered. Writing in a country which is, so long as the unequal distribution of land continues, fully populated, the authors admit the necessity for some method of restraining the increase of families. They consider the propositions of the Neo-Malthusians for limiting the increase by various artificial measures, and decide in favor of a different course. They observe: "It seems to us, however, essential to recognize that the ideal to be sought after is not merely a controlled rate of increase, but regulated married lives. Neo-Malthusianism might secure the former by its more or less mechanical methods, and there is no doubt that a limitation of the family would often increase the happiness of the home; but there is danger lest, in removing its result, sexual intemperance become increasingly organic. We would urge, in fact, the necessity of an ethical rather than a mechanical

'prudence after marriage;' of a temperance recognized to be as binding on husband and wife as chastity on the unmarried. . . . We need a new ethic of the sexes; and this not merely or even mainly as an intellectual construction, but as a discipline of life; and we need more. We need an increasing education and civism of women,—in fact, an economic of the sexes very different from that nowadays so common, which, while attacking the old coöperation of men and women because of its manifest imperfections, but offers us an unlimited and far more mutually destructive industrial competition between them instead. . . . . And while our biological studies of course for the most part only point the way towards deeper social ones, they afford also one luminous principle toward their prosecution,—that thorough parallelism and coincidence of psychical and material considerations, upon which moralist and economist have been too much wont to specialize."

The authors do not state clearly what their "new ethic" is to be, excepting that it is to be based on a thorough recognition of the basis of biologic fact which underlies the problem. They are evidently not in sympathy with the entrance of women into either industrial or political competition with men, nor do they see in the present position of woman anything more than the natural outcome of natural evolution. "Instead of men and women merely laboring to produce things, as the past economic theories insisted, or competing over the distribution of them, as we at present think so important, a further swing of economic theory will lead us round upon a higher spiral to the direct organic facts: So it is not for the sake of production or distribution, of self-interest or mechanism, or any other idol of the economists that the male organism organizes the climax of his life's struggle and labor, but for his mate; as she, and therefore he, also, for their little ones. Production is for consumption; the species is its own highest, its sole essential product. The social order will clear itself as it comes more in touch with biology."

General Notes.

GEOGRAPHY AND TRAVELS.

Mexico.—In a communication made to the Academy of Natural Sciences of Philadelphia, at a recent meeting, Professor Heilprin placed on record his barometric determinations of the heights of the four loftiest summits of the Mexican Republic,—Orizaba, Popocatepetl, Ixtaccihuatl, and the Nevado de Toluca. From these it would appear that considerable corrections will have to be made in geographies of the recorded heights of these far-famed giants of the South. All the observations were made by means of a carefully tested aneroid barometer, and the data computed from almost simultaneous observations made at the Mexican Central Observatory of the City of Mexico, and from barometric readings made at the sea level at Vera Cruz. The The equable condition of the atmosphere at the time these observations were made rendered the possibility of the occurrence of possible errors of magnitude almost *nil.*

Height of Popocatepetl.—The height of Popocatepetl, commonly accepted as the highest peak, was recorded by Alexander von Humboldt in 1804 as 17,720 feet. Several measurements have been made since the date of the grigonometrical observations of the distinguished German traveler, and with results varying from 17,200 feet to somewhat over 18,000 feet. Professor Heilprin's measurements give 17,523 feet, or 200 feet less than the estimate of Humboldt, as corrected by his astronomical associate, Oltmanns. The significant fact, however, pointed out, that while geographers have almost universally accepted Humboldt's determinations and figures, they have neglected to take account of the newer data which have been made possible through the leveling of the Mexican Railway, which was constructed a few years since. These show that the estimate of the elevation of the City of Mexico (7,470 feet) and of the adjoining plateaus, which have served as a basis for most of the angle measurements of the mountains, have been placed 123 feet too high. Allowing for this excess, a striking correspondence is established between the early measurements and those obtained in the spring of the year by the Philadelphia expedition.

The ascent of the peak was made on the 16th and 17th of April by Professor Heilprin and Mr. F. C. Baker, the rim of the crater being reached at 11.30 o'clock on the morning of the 17th, and the culminating point early in the afternoon of the same day. Little difficulty was encountered in the ascent beyond that which is due to the inconvenience arising from the highly rarified atmosphere. The snow field was found to be of limited extent, and not more than from five to ten feet in depth, and was virtually absent from the apex of the mountain. The surprisingly mild temperature of the summit, 45 degrees Fahrenheit, rendered a stay of several hours in cloudland very delightful.

THE MOUNTAIN OF ORIZABA.—With regard to the elevation of what is commonly supposed to be the second highest summit of the Mexican Republic, the peak of Citlaltepetl or Orizaba, the results of Professor Heilprin's determinations show more marked variations from those of most of the earlier investigators, and more particularly from those of Humboldt. The latter determined the height of the mountain, by means of angles taken from near the town of Jalapa, to be 17,375 feet, while a still earlier determination by Ferrer, in 1796, and recorded in the transactions of the American Philosophical Society, gave 17,879 feet. The latter estimate has been generally adopted by German geographers, and Humboldt himself has considered it more nearly representing the truth than his own measurement. The Mexican geographers, on the other hand, have adopted the measurement of Humboldt, or that which was obtained by the National Commissions of 1877, and which indicated a height of 17,664 feet.

Professor Heilprin, with three of his scientific associates and eleven guides, made the ascent of the mountain on the 6th and 7th of April, or ten days before the ascent of Popocatepetl. The last camp, at a height of some 13,000 feet, was left shortly before five o'clock in the morning of the second day, and after a difficult and continuous struggle of twelve hours through loose boulders, sand, and a much cut-up ice cap, the party—or rather the fragment which succeeded in holding out—finally reached the rim of the crater.

A photograph was here obtained of the depression which marks the summit of this most symmetrical cone of the North American continent. Professor Heilprin's measurement, which was made at a point about 120 feet below the apex of the cone, indicates a total height of the mountain of 18,206 feet, or some 325 feet in excess of the measurement of Ferrer, and upwards of 800 more than that of Humboldt.

The equal conditions of the atmosphere under which the measurements of both the peaks of Orizaba and Popocatepetl were made, and

the fact that the two measurements were made with the same instruments, after an interval of only ten days, appear to leave but little room for doubt that the latter determination is within close limits the correct one. There thus seems no question but that the first place among Mexican volcanoes must be accorded to the "Star Mountain."

The sense of excessive fatigue which marked the ascent of this mountain as compared with that of Popocatepetl was considered in itself a sufficient index of the much greater elevation. Messrs. Witmer Stone and F. C. Baker, two of Professor Heilprin's associates, were compelled to desist from the final attack upon the mountain when not more than some 300 feet below the summit. Mr. Le Boutillier's strength failed him at an elevation of about 14,000 feet.

As upon Popocatepetl, the snow cap upon Orizaba, although arising 2,400 feet, or nearly half a mile, above the summit of the highest peak of the Alps, was a comparatively insignificant development. Only a quarter of an hour was passed on the crest of the mountain when the difficult descent through the numerous *seracs* of the ice was made. The camp was reached at a little after eight o'clock in the evening, thus completing a remarkable round of mountain-climbing of fifteen successive hours.

The views from the slopes of the mountain are described as being surpassingly grand, far exceeding anything that Professor Heilprin had hitherto seen in his travels. Far off to the west the giants Popocatepetl and Ixtaccihuatl were clearly outlined against the sky at a distance of about 100 miles, while to the east and south the eye wandered over a seemingly endless expanse of plateaus and lowlands, penetrating through a series of successive cloud-planes.

ASCENT OF IXTACCIHUATL.—The ascent of the third highest peak of the Republic, Ixtaccihuatl, was made on the 27th of the same month on which the two other ascents above noted were also made. In its general features, this mountain differs broadly from the two peaks before mentioned. Although the remains of a volcano, it no longer presents either the symmetry or conical outline of its more famous rivals. A strong, flowing crest, covered with a heavy deposit, some 75 or 100 feet in thickness, of snow and ice, serves readily to distinguish the familiar "White Woman" of the plain of Auahuac.

Above what is now the highest point there at one time arose the crater wall, but the destruction through natural causes of the summit has completely obliterated all traces of both the crater and wall. The heavy cap of snow, a true *firn*, or *nèvè*, feeds one or more glaciers which descend the western slopes. Across one of these glacial ice

sheets, whose nature was now for the first time made known to the Mexicans, the dangerous ascent was accomplished. Huge crevasses at short intervals barred the progress of the march, but the point, estimated to be about 75 yards below the summit, was reached about 10.30 o'clock in the morning. Two impassable crevasses, cutting the crest of the mountain at right angles, prevented a nearer approach to the apex.

Professor Heilprin's measurements determined the height of this mountain to be 16,962 feet, or from 800 to 1,300 feet above that which is accorded to it by Mexican geographers. This determination, on the other hand, accords very closely (within 11 feet) with the very careful, but now generally overlooked, trigonometrical measurements made in 1857 by Sonntag, under the auspices of Baron von Müller.

It is difficult to account for the low value of the height of this mountain given by Humboldt and the Mexican geographers, in view of its close proximity to Popocatepetl. So nearly do they appear of equal height that the eye at first fails to distinguish which of the two summits is the highest. German geographers, however, in a few cases, have adopted Sonntag's measurements, neglecting, however, as in the cases of Popocatepetl, to make allowances for the error, in this case of 125 feet, which is indicated by the leveling of the Mexican Railway.

The temperature on the summit of Ixtaccihuatl was found to be much lower than on either of the other peaks, being 32 degrees Fahrenheit.

Ascent of Nevada de Toluca.—The fourth highest summit of the Republic, the Nevado de Toluca, was ascended by Professor Heilprin and Mr. Baker on the 25th of April. This mountain, owing to its lesser elevation, has a much easier ascent than the others. In fact, it can be ascended by horseback to within about 600 feet of the apex. The rim of the broken crater is extremely ragged and narrow, descending with almost equal abruptness to the inner and outer faces of the volcano. At some points the crest is so attenuated that it can be readily straddled. This feature recalls the famous *Polnischer Kamm* of the Carpathian Mountains, which Professor Heilprin ascended in 1878, and from which there is obtained a precipitous descent on the one side into Gallicia, and on the other into Hungary.

The barometric determination of the Nevada de Toluca gave a height of 14,952 feet, and gave approximately the mean between the determination of Humboldt and those of a class of students from the School of Engineers of the city of Toluca.

In regard to the position which the peak of Orizaba holds to the mountains of the North American continent generally, it may be said that its only rival without the Mexican domain is Mount St. Elias, situated on approximately the 141st parallel of latitude, and whose summit is claimed both by Great Britain and the United States (Alaska) as their possession.

So broadly divergent, however, are the results of the measurements of this mountain that as yet it has been impossible to obtain even remote concurrence in the views of geographers. Thus the early measurements of La-Pèrouse, made in 1786, give less than 13,000 feet. The British Hydrographic Chart of 1872, with its data borrowed from still earlier charts, gives 14,970 feet, and this estimate is the one which is generally followed by the English and a number of American geographers. Malespina in 1791 determined the height by means of angles, taken from near the position of Fort Mulgrave, to be 17,851 feet, which figure is reduced by Tebenkoff by somewhat more than 900 feet.

The most recent carefully conducted series of measurements are those which were made by Mr. W. H. Dall, under the auspices of the United States Coast Survey, in 1874. These yielded results ranging from a little more than 18,000 to nearly 20,000 feet. The measurements were made from distances of 69, 127, 167 miles, and it is more than likely that the discrepancy in the results obtained is due to the very small angles of measurements, and to an uncertainty regarding the actual position of the mountain.

The extreme variation of nearly 2,000 feet in a mountain less than four miles in height renders the correctness of the determinations extremely doubtful. With little doubt Mount St. Elias is considerably more elevated than appears on many of the English and German maps (14,975 feet), but in how near it approaches the height of the Mexican volcanoes is still a question for future solution. The existing evidence seems to point to the "Star Mountain" of Mexico, the peak of Orizaba, with its 18,200 feet, as the culminating point of the North American continent.—*Philadelphia Ledger.*

GEOLOGY AND PALEONTOLOGY.

The Origin of the Sycamore.—The American origin of our sycamore was long denied by European botanists, and was only rendered certain by its discovery in a fossil state by Prof. Lesquereux in a late deposit of the Mississippi valley. Specimens were sent to that great authority on these subjects, Dr. Oswald Heer, of Zurich, who could find no characters by which to distinguish the fossil from the living form, and who regards this as a final settlement of the question. But through the researches of Lester Ward we now learn that the genus itself, the entire type of vegetation to which the plants belong, is American, and that numerous and strange archaic forms of this type formed umbrageous forests on the shores of the great inland Laramie sea where the Rocky Mountains stand, and of the ocean at a time when it extended northward across what are now the great plains of the United States and Canada. (Proc. U. S. Nat. Mus., Vol. XI.)

The Cuboides Zone.—In a paper read before the Geol. Soc. Am., Dec. 28, 1889, by H. S. Williams, the author concludes, after a study of the Cuboides zone and the Tully limestone, that within narrow limits, geologically speaking, the point in the European time scale represented by the beginning of deposition of the Cuboides Schichten of Aix la Chapelle and Rüdesheim, is represented in New York sections by the Tully limestone; and second, that the representative of the fauna of the Cuboides zone of Europe is seen in New York, not only in the Tully limestone, but in the shaly strata for several hundred feet above.

Therefore, if we wish to express precise correlation in our classification of American rocks, the line between Middle and Upper Devonian formations should be drawn at the base of the Tully limestone, to correspond with the usage of French, Belgian, German, and Russian geologists, who include the Frasnian, Cuboides Schichten, and correlated zones in the Upper Devonian.

In discussing the subject Mr. C. D. Walcott remarked: "Prof. Williams' paper is of unusual interest, as he has shown very clearly that the theory of Huxley that there is no homotaxial relation between the sub-division of the geologic systems on the American and European continents is not altogether correct. This study of the Cuboides

zone has shown one limited horizon, at least, that is widely distributed in Europe which is also readily recognized in the state of New York."

The Echinodermata of the Carboniferous.—C. R. Keyes, in the *Am. Jour. Sci.*, Sept. 1889, discussing the Carboniferous Echinodermata of the Mississippi basin, recapitulates as follows:

It appears that (1) the most characteristic faunal group was pre-eminently dual in its general aspect, the Crinoidea greatly predominating during the first part and the Blastoidea during the latter portion of the period; (2) that a large proportion of the genera of Echinoderms became extinct toward the close of the Keokuk; (3) that of the Crinoidal genera represented in the St. Louis and Chester, nearly one-half of the number did not occur in the earlier epochs; (4) that among the Crinoidea in general the abrupt and extensive differentiation in certain anatomical features toward the end of the Keokuk are suggestive of decided changes in the biological and physical conditions of environment; (5) that the faunas of the Burlington and Keokuk are very closely related genetically, the two being practically continuous; (6) that if the members of the Lower Carboniferous of the Mississippi are to be synchronized with the two divisions of the Appalachian Lower Carboniferous, the line of demarkation is far more apparent at the close than at the beginning of the Keokuk epoch.

A Recent Find of Castoroides.—Interest attaches to a recent find of *Castoroides ohioensis*, since the species, though known since 1838, has heretofore been studied from rather meagre fragments. This find, which was made in Indiana is well nigh a complete skeleton.

The parietal and occipital regions of the skull are wanting, but they have been well studied already. The dentition, however, is perfect, both above and below, and is more fully developed than in the Clyde skull found in 1840. The vertebræ in front of the pelvis are all present, except two of the dorsal and four of the cervical. The two most important, the atlas and axis, were found.

The shoulder-blades, clavicles, and fore-legs, minus the feet, show an animal powerfully developed anteriorly. The tail is proportionally about as long as that of the beaver. Everything about it indicates that it was an important and powerful member. In the middle and more posterior region the transverse processes are broad, heavy, and bifurcate, as in the beaver, but relatively not nearly so long. If its tail was flat it was not so wide as that of the beaver. It was five-toed and plantigrade.

The fourth metatarsal is the longest and stoutest bone of the series. The fifth does not join to the tarsus, but articulates with the outer under side of the base of the fourth. It could hardly have the skeleton of the foot in so many respects like that of the beaver, and not have been web-footed. The entire length of the foot must have been fully twelve inches.

The general size and character of the skeleton sustain the conclusions of Dr. Wyman and others that the animal was "as large as a black bear."—JOSEPH MOORE, *Richmond, Ind.*

Geological News.—General.—H. A. Wasmuth maintains that in "bedded" mineral deposits no "inversion" or "overlapping" of the strata can take place without fracture and more or less dislocation; and that, in general, the dislocations of the strata take place in one of two ways: either the portion of a mineral deposit on the hanging wall of the fracture or fault is in a lower position than the portion on the foot wall, or it is in a higher position. Occurrences of the former sort are called "transverse faults;" of the latter, "longitudinal faults," or overlaps. (Jour. Franklin Insti., Aug. 1887.)

Prof. N. S. Shaler suggests that the origin of the Florida uplift is in all probability the same as that of the "Cincinnati anticlinal," and that the peculiar sand-ridges found in the lake district have been shaped beneath ocean waters affected by strong currents. If this latter theory is true, then we are compelled to believe that the elevation of the area above the sea level took place with extreme suddenness. The problem in this field is substantially like that which we have in the Kame districts along the southern shore of New England. (Bull. Mus. Comp. Zool., Vol. XVI., No. 7.)

It is proposed by F. H. Knowlton (Proc. Nat. Mus., Vol XII., pp. 601–617), in his revision of the Araucarioxylon, to separate Cordaites from the other Paleozoic woods; and, in accordance with Felix's suggestion, to adopt Endlicher's name Dadoxylon for the remainder, and to restrict the use of Araucarioxylon to the Mesozoic and Tertiary forms.

Cretaceous.—R. T. Hill has published an annotated check-list of the Invertebrate Fossils from the Cretaceous Formations of Texas. It comprises 2 species of Protozoa, 8 Cœlenterata, 16 Echinodermata, 5 Bryozoa, and 59 Lamellibranchiata.

J. S. Diller has discovered a number of sandstone dikes in the Sacramento valley in California. Their position and the peculiar way in which they intersect the Cretaceous sandstones and shales, their banding and the appearance and position of the biotite in the dike rock,

afford conclusive evidence that these dikes record seismic movement during the Tertiary. (Bull. Geol. Soc. Am., Vol I.).

G. M. Dawson proposes (*Am. Jour. Sci.*, March, 1890) the name Nanaimo Group instead of Dr. White's "Vancouver," to designate the equivalent of the Chico Group in the Vancouver Island region.

In the *Am. Jour. Sci.*, Oct. 1889, are some suggestions from G. H. Eldridge as to a method of grouping the formations of the Middle Cretaceous. He proposes to include in the lower of the more general divisions the formations of the Fort Benton and Niobara; in the upper, the Fort Pierre and Fox Hills; for the former no better name can be found than the one now in use, Colorado; for the latter the name Montana is now for the first time proposed. It is, however, etymologically objectionable, because it is found principally on the plains!

R. T. Hill does not concur in the proposed suggestion to abandon the Meek and Hayden sub-division of the Upper Cretaceous. If the beds lose their identity in Colorado, they appear in Texas in a manner which only confirms the original Nebraska section in its characters and succession. (*Am. Jour. Sci.*, Dec. 1889.)

Various widely scattered observations enable G. M. Dawson to state (*Am. Jour. Sci.*, Aug. 1889) that a great earlier Cretaceous formation, beneath the horizon of the Dakota, is more or less continuously developed over a vast tract of country, the eastern edge of which lies to the east of the present line of the Rocky Mountains, from the 49th parallel to the Arctic Ocean, and which is represented to the west as far as the vicinity of the mouth of the Fraser River, the Queen Charlotte's Islands, and in the Yukon Valley beyond the 141st meridian, in the interior of Alaska.

Mesozoic.—After a thorough study of rocks from twenty-six localities in the Connecticut valley, W. M. Davis and C. S. Whittle have come to the conclusion that the eastern trap ranges present a uniform association of the numerous characters of extrusive sheets, while the western trap range as consistently manifests the several characteristics of an intrusive sheet. (Bull. Mus. Comp. Zool., Vol. XVI., No. 6.)

A recent communication from R. Lydekker to the *Quar. Jour. Geol. Soc.*, 1890, contains an account of Iguanodont remains from the Wadhurst clay; a description of a metatarsus of a Megolausaurian (*M. dunkeri*) from the same deposit; and a note in regard to some vertebræ of a Sauropterygian.

In an address to the Cambridge Entomological Club, Jan. 10, 1890, Mr. S. H. Scudder gave the following brief *résumé* of recent knowledge of Mesozoic insects:

"The horizon has been extended of late years by the thorough discussion of the Bavarian insects by Deichmüller and by Oppenheim; by the careful exploitation of a new locality for Triassic insects at Dobbertin, Germany, by F. E. Geinitz; by the considerable number of new generic and specific types of cockroaches from the secondary rocks of England, described by myself; by the repeated though not extensive discoveries of Fritsch in Bohemia, adding interesting material for our very meager knowledge of Cretaceous insects; and by the discovery at Fairplay, Colorado, of a collection of Triassic cockroaches of special importance."

Palæozoic.—According to C. R. Keyes the remnants of an exceedingly rich and varied fauna that once tenanted the littoral zones of a vast Carboniferous sea, are found in the vicinity of Burlington, Iowa. The Gastropods of the Kinderhook beds include upwards of fifteen genera and fifty species. But only two of the generic groups, Platyceras and Straparollus, have thus far been recognized in the Burlington strata, in which there occur eight species of the first genus and two of the second. (Proc. Phila. Acad. Sci., Sept. 1889.)

S. A. Miller and F. E. Gurley have described (*Jour. Cin. Soc. Nat. Hist.*, April, 1890) some fine Crinoids from the Coal Measures and sub-Carboniferous rocks of Indiana, Nevada, and Iowa. A new family name, Eupachycrinidæ, is made to include the genera Eupachycrinus and Delocrinus, each containing two new species, and Ulocrinus, containing three. The remaining 45 new species are referred to 21 genera, of which four are new. This paper embraces more important novelties than any one recently published. It is well illustrated.

In the *Quart. Jour. Geo. Soc.*, May, 1890, two new species of Rhachitomous Stegocephali are described and figured by R. Lydekker, viz.: *Macromerium scoticum*, from the Carboniferous of Scotland; *Eryops owenii*, from the Karoo system of South Africa. The latter is the first representative of the North American Stegocephali found at the Cape.

W. B. Dwight has demonstrated from fossils collected in that region that the Calciferous is one of the most prominent components of the Millerton-Fishkill limestone belt.

Cænozoic.—In a paper entitled Structure and Origin of Glacial Sand Plains (Bull. Geol. Soc. Am., 1890) W. M. Morris states that

his observations of the New England sand plains are in accordance with the generally accepted explanations.

E. T. Newton has recently described some Eocene siluroid fishes, *Arius crassus*, *Arius baroni*, and *Arius gagorides*. (Proc. London Zool. Soc., 1889.)

The Cernaysian Mammalia are reviewed in Proc. Phila. Acad. Sci., 1890, by H. F. Osborn. The collection is in the private museum of Dr. Victor Lemoine, and is not thoroughly known or appreciated abroad, except by those who have had the good fortune to examine the original types.

W. B. Clark (Bull. Geol. Soc. Am., Vol. I.) notes the strange commingling of different faunas in the Tertiary deposits of the Cape Fear region.

In a paper on Glacial Phenomena in Canada, Robert Bell discusses the causes of changes in level, and remarks that the elevation of the land still in progress in north polar regions indicates that we have passed the period of greatest warmth, and that a colder condition has again begun to creep upon us from the north.

G. F. Wright (Bull. Geol. Soc. Am., Vol. I.) defines the Oak Knolls, a part of the ridge separating Lake Ontario from Lake Huron, as a moraine of retrocession. This ridge probably existed as a long island in the great glacial Lake Erie-Ontario.

T. C. Chamberlin (Bull. Geol. Soc. Am., Vol. I.) presents some additional evidences bearing on the interval between the glacial epochs. These evidences are the trenching of the valleys of the Mississippi, Ohio, Allegheny, Susquehanna, and Delaware Rivers. The cutting of these trenches rudely measures the length of the interglacial interval.

At a meeting of the Phila. Acad. Sci., 1888, Otto Meyer determined a collection of fossil Tertiary invertebrates imbeded in sand which filled the inside of a *Balanus convexus* Brown, found on the west side of Chesapeake Bay. The list comprises 15 Gastropoda, 8 Lamellibranchiata, 1 Balanidæ, 1 Ostracoda, 3 Foraminifera.

R. Lydekker, in a recent paper (*Quart. Jour. Geol. Soc.*, 1890), submits sufficient evidence to prove beyond reasonable doubt the occurrence of the striped hyæna in the Tertiary of Val d' Arno.

G. M. Dawson calls attention (*Geol. Mag.*, Vol. I.) to the noteworthy heights at which glaciation has now been found to occur on some of the higher points in the southern interior of British Columbia. These heights range from 4340 to 7200 feet.

A recent study of the corresponding series of beds in the Paris and Hempstead basins leads Mr. A. Blytt to think that the attenuation of strata was effected by a general cause, and it seems highly probable that this cause is the precession of the equinoxes.

In the Proc. N. Y. Microscopical Soc., 1890, is found a synopsis of the Cretaceous Foraminifera of New Jersey, compiled by Anthony Woodward. The object of this paper is to bring together all the work that has been previously done, and the observations that have been made on the Cretaceous Foraminifera of New Jersey from 1833 to 1889.

Joseph Moore (*Jour. Cin. Soc. Nat. His.*, April, 1890) describes the tooth of a gigantic rodent found in northern Georgia. Its striking feature is the peculiar ribbing and flutting of the enamel throughout the length of the tooth. He proposes the name *Castoroides georgienis.* After an examination of the specimen, Prof. Cope states that it is the inferior canine of the *Hippopotamus amphibius.*

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A suite of rocks collected in Madagascar by Rev. R. Baron[2] has been examined by Hatch,[3] who separates them into gneisses, granitite, olivine-norite, pyroxene-granulites, pyroxenites, and basalts. In the olivine-norite the plagioclase is perfectly transparent, and has an undulous extinction. The olivine is surrounded by a reactionary rim consisting of an inner zone of hypersthene and an outer one of actinolite. The pyroxene-granulite is evidently a basic eruptive that has suffered dynamo-metamorphism. It contains pyroxene, hornblende, and garnet, besides the usual constituents of granulite. Among the basalts many varieties are described. In one variety, the augite and olivine, when present, are in porphyritic crystals, slightly corroded, and including portions of the microlitic ground mass. The augite is grouped around the olivine, which is twinned. A few grains of quartz are present. A second variety contains hornblende and biotite porphyritically developed. All the augite of this rock is zonal, with a different extinction in the various zones. In some the hour-glass structure was observed. Twinning is frequent. A glassy basalt includes hornblende crystals and fragments of quartz. Some of the hornblende has been entirely dissolved, and in its place has been formed an aggregate of augite and magnetite.

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] *Quart. Jour. Geol. Soc.*, XLV., May, 1889, p. 305.

The quartz fragments are surrounded by zones of colorless glass containing augite microlites, which are in turn surrounded by zones of brown glass enclosing microlites and crystals of augite and granules of magnetite.——According to Vénukoff,[4] basalts play an important role in the geology of Mongolia. They consist principally of feldspar, augite, olivine, ilmenite, and magnetite. The feldspar is usually in but one generation. When in two, the phenocrysts are anorthite and the microlites labradorite. The augite is usually in two generations, the larger crystals being violet in color, while the smaller ones are green. In some cases the porphyritic augites are made up of an aggregate of small grains grouped in such a way as to present the outline of crystals. These aggregates are sometimes surrounded by a rim of grains of the second consolidation. Between the minerals above mentioned there is often a little of an amorphous base containing globulites and microlites. The quartz of an inclusion of granite in this basalt is surrounded by a zone composed of augite and small, light-colored microlites. The biotite of the granite has been transformed into a granular mass of magnetite, quartz, and a light brown opaque substance. Around it is often a zone of augite grains. Around the feldspar the basalt paste becomes light colored, the crystal components are more rare, and in their places are various microlites. Within this is a band of augite microlites, and within this band, immediately surrounding the feldspar, is a zone of colorless glass. The feldspar itself is much fractured.——The greenstones[5] of Wicklow, Ireland, occur in intrusive sheets and dykes. They are quartz-mica-diorites (composed of quartz, plagioclase, orthoclase, biotite, hornblende, and a little malacolite, chlorite, and apatite), quartz-diorites, diorites, augite-diorites (consisting of plagioclase and grains and crystals of sahlite or malacolite), diabases, epidiorites, chlorite-schists (produced by dynamic metamorphism from diabase), and serpentines, derived from diabases.——Mr. Somervail[6] regards the gabbros, greenstones, granulites, and hornblende-schists of the Lizard, Eng., as parts of the same rock-mass, the latter-named rocks, according to him, having originated from the former by pressure.——Mr. Marstens[7] gives us a very brief description of diabases and diabase porphyrite from among the Triassic traps of Nova Scotia.——A few dykes[8]

[3] Ib., p. 340.
[4] Proc. verb. soc. Bélg. de Géol., II., 1888, p. 441.
[5] *Geol. Magazine*, 1889, p. 261.
[6] *Geol. Magazine*, Sept. 1889, p. .
[7] *Amer. Geol.*, Mch. 1890, p. 140.
[8] Darton and Diller. *Amer. Jour. Sci.*, Apr. 1890, p. 269.

occurring in the Upper Silurian and Lower Devonian beds of the Appalachians in Highland Co., Va., consist of porphyritic basalt composed of phenocrysts of augite and olivine in a ground-mass of plagioclase, augite, magnetite, and a few flakes of biotite.——Sandberger[9] mentions cordierite occurring as an inclusion in the basalt of the Calvarienberg, near Fulda, in Hessen. He also gives an analysis of the phonolite of Heldburg, near Coburg.——Holland[10] has isolated the porphyritic crystals from the basalts of Mull, Eng., and finds them to correspond in composition and other properties with anorthite of the composition $AbAn_8$.——In the phonolite of the Serra de Tingua, Brazil, are coarse-grained patches with the structure of foyaite. They have the form of leucite crystals, and are, according to Hussak,[11] nothing more or less than pseudo-crystals of this mineral. They consist of a thin wall composed of crystals of orthoclase, surrounding a coarse-grained aggregate of the constitution of foyaite. The external form of the pseudomorphs is so perfect that the angles of leucite can readily be detected upon them.——Mr. C. W. Hall[12] records the fact that the Trenton limestone of St. Paul and Minneapolis., Minn, is composed of untwinned rhombohedra of calcite. An argillaceous bed lying above the limestone contains many rhombohedra of calcite imbedded in its matrix.——Dr. Lawson[13] describes an amygdaloidal trap from the Animikie series of Thunder Bay, Canada, that contains about 2% of native copper.

Mineralogical News.—NEW MINERALS.—*Inesite.*—At the mine Hilfe Gottes and Ferdinand, near Nanzenbach in the Dillenburg region, Germany, is a new manganese mineral associated with various ores of this metal. The new mineral is a dense colorless to dark brown substance, whose hardness varies between 5 and 6, and whose streak is yellowish-brown. Its fusibility is 3. In other specimens the mineral occurs in radial aggregates of a flesh-red color, with a hardness of 6–7, a specific gravity of 3.103, a white streak and a glassy lustre. It has an extinction of 20° against one of its cleavages, and is regarded by Schneider[14] as triclinic. Its composition is

SiO_2	Al_2O_3	FeO	MnO	MgO	CaO	H_2O
43.92	.29	.69	38.23	.28	8.00	8.49

[9] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 101.
[10] *Miner. Magazine*, Mch. 1889, p. 154.
[11] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 166.
[12] Bull. Minn. Acad. Nat. Sciences, Vol. III., No. 1., p. 111.
[13] *Amer. Geologist*, Mch. 1890, p. 174.
[14] *Zeits d. deutsch. geol. Ges.*, XXXIX., 1889, p. 829.

In many of its characteristics it resembles rhodotilite. Its axial ratio, as calculated by Scheibe,[15] is $a : b : c = .9753 : 1 : 1.3208$, with $\alpha = 92° 18' 12''$, $\beta = 132° 55' 54''$, $\gamma = 93° 50' 42''$.——*Rhodotilite* is described by Flink[16] from the Harstig mine, Pajsberg, Sweden. It is identical in all its properties with inesite, but is fresher. Its analysis gave:

SiO_2	FeO	MnO	MgO	CaO	PbO	H_2O
43.67	1.11	37.04	.15	9.38	.77	7.17

which corresponds with the formula 2 (MnCa) $SiO_3 + H_2O$. Recognizing the similarity between *rhodotilite* and the mineral described by Schneider under the name *inesite*, Flink has determined to withdraw the former name and has decided to adopt the one proposed by Schneider.——*Lussatite* is described by Mallard[17] as a milky-white fibrous substance surrounding quartz crystals, occurring in the bituminous beds of Lussa, Pont-du-Chateau, France. The fibres are arranged perpendicularly to the bounding planes of the quartz. They have a density of 2.04, and contain 7.9–8.3% of water, which they lose when heated without changing their optical behavior. The loss of water is supposed to be due to a mixture of opal with the fibrous mineral, which the author regards as crystallized silica differing from quartz and chalcedony, since it possesses optical properties that differ from those of these minerals. Its index of refraction for sodium light is 1.446.——*Heliophyllite*, from Pajsberg is a shining, sulphur-yellow, flaky substance[18] accoompanying the *inesite* (rhodotilite) from the Harstig mine. It resembles, in appearance, a mineral described by Nordenskjöld[19] as associated with *ekdemite* at Långban. The new mineral is orthorhombic, with the plane of its optical axes normal to the cleavage face. The axial angle is large, and the dispersion $\rho > v$. The density is 6.886, and hardness 2. On the Långban mineral the planes $P\breve{\infty}$ and $0P$ occur on twinned forms, with ∞P the twinning plane, and $a : b : c = 1.0343 : 1 : 2.2045$. Heliophyllite has practically the same composition as *ekdemite*, from which, however, it differs in its crystallographic properties.

	PbO	MnO. FeO	As_2O_3	Cl
Heliophyllite	80.70	.54	11.69	8.00
Ekdemite	81.28		12.03	8.63

15 Ref. *Neues Jahrb. f. Min.*, etc., 1890, I., p. 21.

16 Öfv. af. Kongl. Vetensk. Ak., För. 1888, Stockholm, p. 571. ref. *Neues Jahrb. f. Min.*, etc., 1890, I., p. 22.

17 Comptes Rendus, 110, p. 245. Ref. Ber. d. deutsch. chem. Ges., 1890, p. 170.

18 Flink: Öfversigh. af. Kongl. Vetensk. Akad. Förh., 1888, Stockh., p. 571.

19 Geol. Fören. Förh., III., p. 381. Ref. *Neues. Jahrb f. Min.*, etc., 1890, I., p. 23.

——*Barysite.*—At the same Harstig mine Sjögren and Lundström [20] have found a lead silicate associated with garnet, calcite, tephroite, hedyphane and cerussite filling a vein in the iron ores. The mineral occurs in silver-white hexagonal crystals, with a perfect cleavage parallel to oP, and a less perfect one parallel to ∞P. Its double refraction is negative, streak white, hardness, 3, and specific gravity, 6.55. When heated it becomes dark and melts to a brown glass. Dissolves in nitric and hydrochloric acids with the separation of gelatinous silica. Its composition (as a mean of two analyses) is:

SiO_2	PbO	MnO	FeO	CaO	MgO	Ce	Loss.
17.07	78.26	3.51	.16	.41	.59	tr.	.89

leading to the formula $3 (\frac{1}{8} MnO + \frac{7}{8} PbO) 2 SiO_2$.

Miscellaneous.—The second part Hintze's "Handbuch der Mineralogie" [21] concludes the discussion of the topaz group of minerals, and treats of the datholite and epidote groups, vesuvianite, gehlenite, and parts of the tourmaline group. The fullness of treatment that characterized the first part of this remarkable book is continued in the second part. If the promise given by the two parts that have appeared to date is carried to its fulfillment, the complete volume will be a marvel of painstaking labor and patience.——A discussion of some of the facts known with respect to the physical symmetry of crystals, together with some observations made upon the gypsum of Zimmerscheim, in Upper Alsace, lead Beckenkamp [22] to the view that the molecules of crystals are polar, *i.e.*, that they possess different powers at diametrically opposite points, and that, other conditions being similar, a crystal face always possesses a maximum tendency to growth in a certain fixed direction.——In a conglomerate on the Coast of South Devon, near Torquay, England, are numerous pieces of limestone, on the surface of which are botryoidal and spherulitic forms of chalcedony, known as beekite. These are thought by Hughes [23] to have originated by the replacement of portions of the limestone by silica, possibly through the influence of organic substances. The author thinks that the same kind of action may have given rise to many of the old siliceous deposits like flint or chert ——Mr. Dawson [24] has recently given a statement of the present condition of mining in British Columbia, and a description of the minerals of economic value occurring there, and Mr. Coste [24] has issued a statistical

[20] Öfvers. af. Kongl. Vetensk. Ak. Förh., p. 7. Ref. *Neues. Jahrb. f. Min.*, etc., 1890, I., p. 24.

[21] Dr. C. Hintze: Handbuch der Mineralogie, 2d Lief. Leipzig. Veit and Comp., 1890.

[22] *Zeits. f. Kryst*, XVII., 1890, p. 321.

[23] *Miner. Magazine*, Oct., 1889, p. 265.

[24] Ann. Rep. Geol. and Nat. Hist. Surv. of Can. for 1887-88. Reps. R and S.

report on the mineral products of Canada.——In the tourmaline of the tourmaline granite of Striegau, Traube[25] has discovered pleochroic halos around inclusions of rutile and zircon. The color of the halos is some shade of violet, and is independent of the color of the mineral in which they lie. It disappeares upon heating. Garnet, apatite, and quartz inclusions in the same tourmaline are not surrounded by halos.——Among the new instruments, and improvements upon old instruments, used in crystallographic and mineralogical investigations, that have been suggested during the last three months, mention may be made of an apparatus[26] for the production of pressure figures in very small mica plates; of a very simple reflection goniometer constructed by Prof. Groth[27]; of an improved instrument[28] for cutting thin sections of minerals in any desired position; and an improved heating apparatus for use with the reflection goniometer, invented and constructed by the well-known mechanician Fuess.[29]

BOTANY.

Note on a New Species of Actinoceps B. and Br.—In the Sylloge Fungorum of Saccardo but a single species of Actinoceps is recorded, and this is a native of Ceylon. Consequently it is interesting to discover that another form, undoubtedly belonging to the same peculiar genus of Hyalostilbeæ, occurs rarely in Minnesota. In April a number of moist chambers were prepared by Mr. E. P. Sheldon in the botanical laboratory of the University of Minnesota. In these chambers a large variety of nutritive substances were placed, and a number of more or less interesting saprophytic fungi have since developed.

The plant, referred to Actinoceps, developed upon the glandular side of a putrescent orange-peel, and formed a little colony of somewhat less than a square inch in extent. The surface of this area, upon examination, was found to be clothed with a thin layer of *Bacillus megaterium* De By., together with other saprogenic bacteria. From this thin layer of micro-organisms the Actinoceps plants arose in num-

[25] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 186.
[26] Steenstrup: Geol. Fören. Förh., Stock., 1888, p. 113. Ref. *Zeits. f. Kryst.*, XVII., p. 429.
[27] *Zeits. f. Kryst.*, XVII., 1890, p. 396.
[28] Ib. XVII., 1890, p. 445.
[29] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 161.

bers, although never so close as to touch each other. The networks of hyphæ at the base of each Actinoceps stipe were found to interlace among the bacilli, and to ramify somewhat widely through the nutritive material. In general the appearance of each stroma was more or less glaucescent, varying in a few individuals to a faint and very light yellow color.

For comparison a transcription of the Saccardian description is given here in English. The original will be found on p. 579 of Vol. IV., and the single species described is "No. 2747."

"Actinoceps B. and Br., Suppl. Fungi of Ceylon . . . Stipe hyaline, cylindrical, composite; hyphæ repeatedly branched and accumulated in a globose head, with radiating spicules; hyphæ sometimes prolonged into radiating, vitreous, granulate spicules, again developed as very slender conidiophores; conidia very minute hyaline.

"*Actinoceps thwaitesii* B. and Br. Stipe 400 to 500 μ in length; head, 140 to 160 μ in diameter; spicules shaped as in sponges, covering the head rather loosely with spines; spore-bearing hyphæ repeatedly branched, sub-flexuose; conidia elliptico-spheroid.

"Hab. In decayed, leathery leaves, Ceylon."

From this it will be seen that the genus Actinoceps differs little from Stilbum, the spicules of the former constituting the diagnostic character. Like Stilbum, the Actinoceps studied in Minnesota has the conidia enclosed within a mucilaginous layer, so that the younger plants generally present a somewhat shining aspect, while the older ones are slightly desiccated, and appear sub-pulverulent.

Comparing the Minnesota Actinoceps with the description of the Ceylonese form certain minor differences in size are noted. Since spore and hypha measurements are omitted in the description of *Actinoceps thwaitesii*, the comparison extends only to the stromatic measurements. While the Ceylonese form shows a stipe 400 to 500 μ in length, that of the Minnesota form is from 700 to 700 μ. The diameter of the head in *Actinoceps thwaitesii* is 140 to 160 μ, while that of the Minnesota form is much larger, measuring from 360 to 400 μ. Additional measurements of the stalk showed its average diameter to be between 45 and 55 μ. From this it is apparent that the Minnesota specimens should be separated from the Ceylonese species, and a description of the American form is appended.

Actinoceps besseyi n. s. Stalk 400 to 700 μ long, 45 to 55 μ in diameter, cylindrical, smooth, hyaline, compacted; head sub-globose, pale glaucescent, armed loosely with projecting spicules, 360 to 420 μ in diameter; spore-bearing hyphæ repeatedly branched, sub-flexuose, 4

μ in diameter, bearing the conidia occogenously. Conidia ellipsoid to elliptico-spheroid, $4 - 5 = 2 - 2\frac{1}{2}\ \mu$. Spicules with cell-walls somewhat thickened, often septate prolonged, sometimes $100\ \mu$ beyond the surface of the globose capitulum.

Hab. On putrid orange-skin among bacteria, Minneapolis, Minn.

It should be noted in passing that the specimens of *Actinoceps besseyi* observed by us were sometimes grown over by a cobwebby network of Diplosporium filaments, which bore occasional spores, but were collected more abundantly on the wet paper in the bottom of the moist chamber, where they formed a luxuriant growth. The Diplosporium was referred doubtfully to *D. album* Bon., from which it differs slightly in the spore measurements.

The Actinoceps above described is dedicated to Dr. Charles E. Bessey, the well-known botanist.—CONWAY MACMILLAN, *University of Minnesota.*

Notes on the Canyon Flora of Northwest Nebraska.—Our party left Lincoln June 17th, and arrived at the Pine Ridge Tunnel early on the morning of the 18th. In the walk from there to Crawford about the only thing of interest found was a very large form of *Viola canadense* L. with a very small flower. In many places this was almost entirely killed by *Æcidium violæ.* In many cases the plant leaves and stems were twisted all out of shape by the fungus.

From Crawford to Harrison brought nothing of interest. Leaving Harrison we pitched our tent in War Bonnet Cañon. Here new things and new variations were continually turning up. One peculiarity of the cañon flora quite noticeable was the difference—in many cases very pronounced—between the floras of the different side cañons. Many plants were found in one cañon and in that one only, though there were many cañons very similar to it. In one cañon *Pyrola chlorantha* Schwarz was found in a considerable quantity, but in one only. In another *Pyrola secunda* L. grew. Some cañons have any quantity of *Populus tremuloides* Michx., others scarcely any.

In nearly all of the cañons, especially the damper, darker ones, *Corallorhiza multiflora* Nutt. grew quite plentifully; while only the darkest cañons afforded the rare *C. innata* R. Br. In a small cañon at the head of Jim creek was found a lavender-yellow variety of the former species. *Habenaria bracteata* R. Br. grew in abundance along the low banks of all the cañon streams. The dry cliffs and slopes of the cañons were covered with the lovely *Calochortus nuttallii* Torr. and Gray. *Fritillaria atropurpurea* Nutt. occurred plentifully in a few

localities, but was generally out of bloom. *Mertensia lanceolata* D.C. was found growing among the short underbrush of the second banks in War Bonnet Canyon.

The weather was too dry for lichens and most of the fungi. Of the former, several interesting Cladoniæ were found together with two or three species of Peltigera. On the north slopes of the dampest cañons *Parmelia olivacea* (L.) Ach., and a sterile form of *Usnea barbata* (L.) Fr., grew very plentifully on the pines everywhere.

Various species of Æcidium and Uromyces occurred generally in large quantities; the most plentiful being *Æcidium abundans* Pk., *Æcid. clematidis* D.C., *Æcid. grossulariæ* Schum., *Uromyces trifolii f. glycyrrhizæ* E. & E., and also *Gymnosporangium clavariforme* (Jacq.) Rees., I., was found quite plentiful in a small side cañon of the War Bonnet, on *Amelanchier canadensis.* Along the higher lands and buttes above the cañons *Ustilago carices* (Pers.) Fück, was found in large quantities. Out on the Hat Creek Basin *Ustilago hyphodytes* (Schlect) Fr., which is considered a rare species, occurred in considerable quantities on *Stipa comata.* Several interesting rock forms of lichens were found on the rocks cropping out near the edge of the "bad lands;" the most plentiful as well as the most beautiful being *Lecanora rubina* (Vill.) Ach. and *L. rubina* var. *opaca.* Ach., Fr. and *Placodium* Sp., near *P. elegans* (Linta) D.C. Many rocks being literally covered by these with a few others.—Tom A. Williams, *Ashland High School, Nebraska.*

Botanical News.—Professor McLaren, of the Maryland Agricultural College, has had his copies of Gray's Manual bound in oil cloth, a decided improvement over the soft and rather bibulous cloth cover usually given the book by the publishers. Now if the margins could be trimmed down it would improve it still more. . . . The fourth number of the memoirs of the Torrey Botanical Club is devoted to a paper by Dr. E. Lewis Sturtevant on "Seedless Fruits." Sixty-one species are mentioned in the paper. The general result appears to be that a tendency to seedlessness is an accompaniment of high development . . . H. S. Jennings published an annotated list of ninety-five parasitic fungi of Texas, in the ninth bulletin of the Texas Agricultural Experiment Station. . . . G. N. Best has examined (Torrey Bulletin for June, 1890) some of the North American roses—those belonging to the group Cinnamomeæ,—and among other changes reduces *Rosa arkansana* Porter, to a variety of *Rosa blanda* Ait., as *R. blanda* Ait., var. *arkansana* (Port.) Best. This reduction, it will be remembered, was suggested by Watson five years ago in Proc. Am.

Acad. Arts and Sci., Vol. XX., p. 336. . . . *Masclef's Atlas des Plantes de France utiles, nuisables et ornamentales* has reached Part X., and continues its promise of excellence. The later numbers have contained notably fine colored figures of *Ononis spinosa, Medicago sativa, Colutea arborescens, Pisum sativum, Coronilla varia, Amygdalus communis, Persica vulgaris, Prunus spinosa,* and *Cerasus vulgaris.* . . . Parts 44 and 45 of Engler and Prantl's *Die Naturlichen Pflanzenfamilien* continue the Euphorbiaceæ, complete the Myrsinaceæ, Primulaceæ, Plumbaginaceæ, and begin the Sapotaceæ. The last-named order is elaborated by Engler, the others by Pax. . . . Professor Gardiner and Mr. Brace published in the Proc. Acad. Nat. Sci. Phil. an interesting provisional list of the plants of the Bahama Islands. . . . Another of the numerous valuable contributions from the Cryptogamic Laboratory of Harvard University has made its appearance in Proc. Am. Acad. Arts and Sciences, Vol. XXV., p. 53, by Wm. A. Setchell, on the "Structure and Development of *Tuomeya fluviatilis*, a red seaweed (*Floridea*) intermediate between Lemanea and Batrachospermum. . . . The May number of *Pittonia* is an unusually interesting one, dealing as it does in its peculiarly sprightly way with half a dozen or more topics. The review of the new edition of Gray's Manual contains much plain talking, some of which may be deserved, while much certainly is not.

ZOOLOGY.

Snakes in High Places!—A discussion occurred some time ago in THE NATURALIST upon the question, "Do Snakes Climb Trees?" to which I contributed one or two items. But just now my farmer friend, Hiram Carpenter, who lives three miles out of town, invited me to call at his place and see where he found a snake four feet and three inches in length and one and a half inches in diameter. The swallows nest under the eaves of his barn, which project some twenty inches from the building. The rafters do not run out more than one-half or two-thirds of this distance, the space between them being quite thickly studded with the mud-nests of the swallows. One pleasant day in June his son noticed quite a commotion among the birds, and called him to the spot. They were amazed to see a large snake clinging to the end of a rafter, with its head in one of the nests, evidently devouring the young birds. The reptile was able to cling to the end of the rafter by hugging it tightly, and was only dislodged after some effort.

It had swallowed two young birds, and another was part way down its throat. The young man had not "believed in killing snakes," but on this occasion he despatched the reptile forthwith. The barn is sheeted up with rough pine boards, upon which there are two coats of paint, and from the ground to the point whence the snake was dislodged the distance is nineteen feet and four inches. How it managed to get to the spot seems altogether a mystery. There was no hole through the side of the barn nor under the roof boards, nor did it seem possible for it to have worked its way from the top of the roof. Then, it was quite as difficult for it to have found a way to the roof. Mr. Carpenter is a most reliable observer of all natural phenomena,—an investigator, really,—but he was unable to form any opinion as to how the reptile reached its prey. He described it as resembling the common garter-snake, except in the matter of its great size, hence I could form no idea as to the species to which it belonged.—CHARLES ALDRICH, *Webster City, Iowa, July, 14, 1890.*

Snakes in Banana Bunches.—Banana bunches brought from tropical America sometimes contain snakes of the family Boidæ, tightly wound round the central stem. A specimen of this kind was taken in Savanna, Georgia, and was sent to the United States National Museum. I identified it as the *Epicrates augulifer*, a native of Cuba. More recently a snake was found in a similar situation in a lot ot bananas in Chicago, and was sent by Dr. J. L. Hancock to the National Museum. Dr. Stejneger has identified it as the *Boa imperator*, the common species of Central America and Mexico. The specimens are always young, as adult boas of the genera named could not be concealed in so small a space.—E. D. COPE.

ENTOMOLOGY.

Recent Literature.—Several notable entomological articles have been recently issued by the National Museum. Mr. Henry Edward's Bibliographical Catalogue of the Described Transformations of North American Lepidoptera, which forms Bulletin No. 35, is a very useful compilation, and ought to stimulate the study of the earlier stages of the group. There are 1,069 species included in the Catalogues, the Tineidæ heading the list with 222 entries, and Zygænidæ bringing up the rear with 13 entries.

Another valuable paper is the Catalogue of the Described Araneæ of North America, by George Marx, which forms No. 782 of the Museum Proceedings, and covers about one hundred pages. The author deserves the thanks of all arachnologists for this careful piece of work.

Other Museum Proceedings contain descriptions by Mr. Lawrence Bruner of New Acrididæ, including the characterization of the three new genera, Dracotettix, Eritettix, and Boötettix; revision of some Tæniocampid Genera by John B. Smith; and descriptions of New Ichneumonidæ by William H. Ashmead.

Professor Alfred Giard has published in the Bulletin Scientifique de la France and de la Belgique an interesting article entitled Sur Quelques Types Remarkables de Champignons Entomophytes. Three colored plates, representing *Entomophora saccharina*, *E. calliphoræ*, *E. plusiæ*, and *Polyrhizium leptophyci* infesting their respective hosts, accompany the paper.

The report of the U. S. Entomologist for 1889 contains accounts of the Fluted Scale (*Icerya purchasi*), Six-spotted Orange Mite (*Tetranychus 6-maculatus*), Horn Fly (*Hæmatobia serrata*), and the Grain Aphis (*Siphonophora avenæ*). A brief synopsis of the work of the division and its agents is given.

Mr. Lawrence Bruner has published in the Bulletin of the Nebraska Experiment Station (Vol. III., Article II.) an extended paper on Insects Injurious to Young Trees on Tree Claims, which will prove useful to western planters.

A New Phalangium.—In a lot of harvest-spiders received from Mr. C. W. Woodworth, Entomologist of the Arkansas Experiment Station, I found a number of specimens of a remarkable species of Phalangium, in which the sexes are very different, the male having extremely long palpi, and the second joint of its chelicerae being articulated with the first at the middle, so as to form a right angle, while in the female the palpi are but little longer than usual, and the second joint of the chelicerae is articulated with the first at the end in the ordinary manner. The species may be called *Phalangium longipalpis.* This case is exactly analogous to that of *Phalangium opilio* of Europe, in which the two sexes are similarly distinguished.

Description.—*Male.*—Body 7 mm. long; 3.5 mm. wide. Palpi 20 mm. long. Legs: I. 30 mm.; II. 47 mm.; III. 30 mm.; IV. 38 mm.

Dorsum light mottled gray, with a darker central marking beginning at the eye eminence, and expanding rapidly to margin of abdomen,

then suddenly contracting and again expanding on the first two abdominal segments; suddenly contracting on the third and running as a broad stripe to posterior extremity. Scattered over the dorsum of the cephalothorax are numerous tubercles, having whitish bases and black tips, and generally having also a black spinose hair arising on one side of the tubercle near the apex of the white portion, and extending beyond the tip of the tubercle; a transverse row of similar tubercles on each abdominal segment. Dorsum of abdomen covered with numerous small black granules. Eye eminence gray, well developed, canaliculate, each carina surmounted by a well-marked series of tubercles, whitish with black tips. Cheliceræ large, light brown, with tips of claws black; first joint long, cylindrical, convex, furnished above with black spinose tubercles; second joint very large, smooth, except for some black spinose hairs, articulated at a right angle with the first, prolonged above in the form of a large conical horn, curved forward. Palpi slender, very long (three times as long as body), smooth, except for rows of stiff black hairs; light brown, except middle portion of femur, which is black. Ventrum, including coxæ, grayish white, with numerous black hairs. Trochanters light brown, almost whitish, with a few tubercles. Rest of legs brown, with femora darker; proximal joints with rows of spinose tubercles.

Female.—Body 7.5 mm. long; 4.5 mm. wide. Palpi 6.5 mm. long. Legs: I. 21 mm.; II. 36 mm.; III. 23 mm.; IV. 32 mm.

Dorsum light mottled gray, with a rather distinct darker central marking beginning at anterior border of abdomen, and expanding rapidly on the first two segments; suddenly contracting on the third segment and running as a stripe to the posterior extremity. Scattered over the dorsum of the cephalothorax are numerous tubercles, having whitish bases and black tips, and generally having also a black spinose hair arising on one side of the tubercle near the apex of the white portion, and extending beyond the tip of the tubercle. A transverse row of similar tubercles on each abdominal segment. Dorsum of abdomen having numerous small black granules. Eye eminence well developed, gray, canaliculate, each carina surmounted by a well-marked series of tubercles like those on the dorsum. Cheliceræ light brown, dorsal proximal portion of first joint mottled with chocolate brown; tips of claws and a blunt tubercle at base of outer claw, black; both joints furnished with scattered black, spinose hairs. Palpi rather long (but very much shorter than in male), slender; very light brown, almost whitish, with middle of femur black; all the joints furnished with well-developed spinose hairs, those on the tarsus being more

PLATE-XXVII.

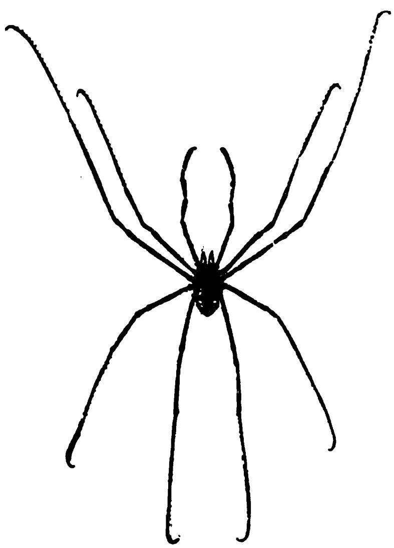


Fig. 1.

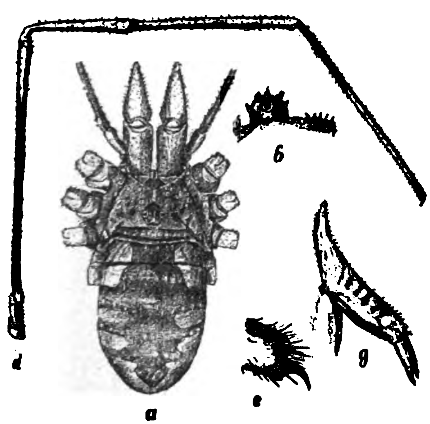


Fig. 2.

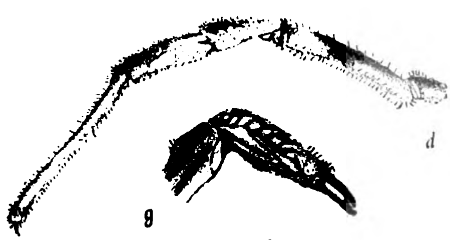


Fig. 3.

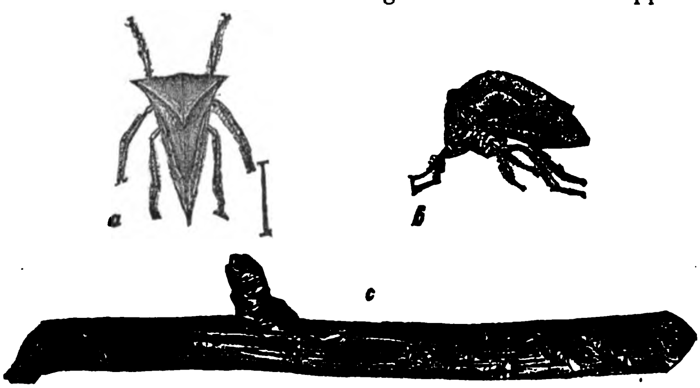
Phalangium longipalpis.

slender than others; claw of tarsus not denticulate, moderately robust. Ventrum, including coxæ, grayish white, with numerous black hairs. Trochanters very light brown, almost whitish. Legs light brown; femora provided with rows of spinose tubercles; tibiæ angular, with rows of fine hairs on angles.

Described from many specimens.

In the accompanying Plate, Fig. 1 represents the male, natural size, while at Fig. 2 are shown the parts magnified, The letters *a*, *b*, *d*, *e*, and *z* show respectively a dorsal view of the body, and a side view of the eye eminence, the palpus, the palpal claw, and the chelicera of the male; while in Fig 3, *d* and *g* represent similar views of the palpus and chelicera of the female.—CLARENCE M. WEED.

Injuries of Buffalo Tree-Hopper.—This insect (*Ceresa bubalus*) has become a serious pest in many parts of Ohio. It is only comparatively lately that it has attracted special attention as a destructive insect, Professor Popenoe having described its work in Kansas about five years ago. During the last winter I have received twigs injured by the egg-punctures of the insect from three counties of the state, and in each of the orchards much damage had been done. Apples and



BUFFALO TREE-HOPPER.—*a*, back view; *b*, side view, both slightly magnified; *c*, apple twig showing egg-punctures.

pears are both attacked. The insect is represented, slightly magnified, at *a* and *b* of the accompanying figure, while at *c* is shown a twig partially covered with the egg punctures of the insect.—C. M. W.

The Maple Bark-Louse.—This insect (*Pulvinaria innumerabilis*), which was so destructive in the central western states about six years ago, is again appearing above the danger line. In some of the leading cities of Ohio it is present on the trees in great numbers, and is causing considerable alarm.

SCIENTIFIC NEWS.

An important scientific expedition left Minneapolis on the 22d of July. Messrs. D. C. Worcester and F. S. Bournes, lately pupils of Professor J. B. Steere, of the University of Michigan, having secured the financial assistance of Mr. L. F. Menage, of Minneapolis, and the endorsement of the Minnesota Academy of Sciences, purpose spending two years or more in the Philippine Islands, where they will devote their time principally to the collection of corals and birds. It is their intention, however, to make frequent detours into the departments of zoology, and they have also determined to collect what fungi they can, paying particular attention to the Sphærioideæ and Gastromycetes. Through the large liberality of Mr. L. F. Menage, the expedition has been fitted out regardless of expense, and will go prepared to prosecute investigations under the most favorable conditions. The great mass of material secured will be studied at the Academy of Sciences in Minneapolis, to which city Messrs. Worcester and Bournes propose to return in 1892 or 1893.

Very important results may be looked for from this expedition. It is not designed merely as a collecting trip; for careful study of the problems of distribution is projected, and doubtless some difficult points will be settled. Both of the investigators are well known and representative western scientific men, and much is hoped for from their work in these little-known islands.

Mr. H. C. Bumpus, formerly Professor of Natural History at Olivet College, Michigan, has been elected associate Professor of Zoology at Brown University, Providence, R. I.

Mr. Ralph S. Tarr has severed his connection with the Geological Survey of Texas.

Dr. Henry Orr, Professor of Natural History in the University of Kentucky, has been appointed Professor of Biology in Tulane University, New Orleans, La.

Dr. Langdon Frothingham, of Harvard Veterinary School, has been appointed Instructor in Biology and Agriculture in the University of Nebraska, at Lincoln.

Dr. T. H. Morgan has been appointed Bruce Fellow at the Johns Hopkins University.

Drs. E. B. Jordan, S. Watase, and C. H. Eigenmann will hold fellowships in Morphology at Clarke University during the coming year.

Mr. H. S. Brode has been appointed Instructor in Zoology in the University of Illinois, at Champaign, Ill.

THE

AMERICAN NATURALIST

Vol. XXIV. SEPTEMBER, 1890. 285.

A MEANS OF PRESERVING THE PURITY AND ESTABLISHING A CAREER FOR THE AMERICAN BISON OF THE FUTURE.

BY ROBERT C. AULD.

I.

THE American bison is, as it nearly always has been, and ever will be, possibly the most interesting and attractive of all mammals. The lamentable, outrageous war of extermination to which he has been subjected is certainly one atrocious specimen of man's most wanton foolishness, for which he ought to blush. Doubtless that extermination is at last regarded with the keenest feelings of remorse; which, though now of so little avail, yet fill those who have latterly championed his cause with fond desires for the recuperation of what is apparently almost a vanishing race. The American bison is, in his royalty, gone,—"passed over" into history. The hardly even smoldering embers that remain,—can they be nursed, fanned into a greater brilliance that might give one the hope of their being revivified into a more life-like, enduring flame?

From numbers that would have put into total insignificance the combined forces of all the various bovine species (and races), for instance, there now remain—how many? The very best that Mr. W. T. Hornaday can figure, they can only be marshalled at a total of one thousand and ninety-one in the entire world. This number

is less, positively, than that claimed by even some of our most improved domestic bovine races. The enumeration takes into account, of course, all individual and scattered specimens in different foreign Zoological Gardens, which are uninfluential on the main body on which depends the fate—so doubtful now—of the species. This main body, this specific entity, this restricted, smothered force, on which the future fate of recuperation depends,—that is, taking into account those only which we know of that can, or could, be utilized for ordinary breeding purposes,—the most that we could liberally estimate such a force at would not be far from about two hundred and fifty. Two-and-a-half hundred: can we do anything for you to redeem the obloquy of the past? Is it possible to preserve that trivial remnant? It would seem presumption to make any assertion to that effect in the face of the transforming rapidity of the extermination from the many countless hordes to the few insignificant herds. Those most interested in the fate of this remnant have, I fear, dire misgivings as to the result. For an animal that was so long so absolutely monarch of his prairie domain,—till the relentless and vicious paleface and the no less destructively inclined redman, finding him generally such an easy prey to their various refined and rude means of murder, made so much more resistless by an animal that had not yet learned the fear of, or to beware of, man's ruse or craft, reduced him to his present state of insignificance,—for such an animal to be expected to re-create itself into some more enduring adjunct of his old enemy's wants, would seem unnatural. The products that were the incitement to this awful slaughter had to be piled almost horizon-high, and then it was not enough to subdue the insatiable, inconsiderate greed of the so-called honorable hunter who followed such a legitimate calling. The lucre-returning "product" was only a trifling portion of the whole. The waste was outrageous, stupendous in its extravagance. Hence the Assyrian-like destruction. For an animal that had reared itself through centuries' implantation of nature's own freedom, instinct, unrestraint, and environment, to be dragged through such abject degradation, and be asked to survive, would seem an insult to this lagger behind,

"superfluous on the stage," left all alone. It would be a modern incongruity, not an instance.

From the generally apparent characteristics and qualities of the species, the sympathizer would entertain—regretfully entertain—a decided negative. Yet often when there is least expectation hope revives.

The buffalo has had, even during all that destruction-dealing process, before his death throes, observers who have, incidentally it would appear, recorded a certain number of facts about their, too noble prey, which are now positively encouraging to us. For instance, for an animal regarded to be an embodiment of mammalian ferocity, it would appear incredible that such an animal should have any inherent traits of gentility or docility. But such is, indeed, the fact. In his experiences with his bitter foe, as forestated, ere the latter days of his regal existence,—before the knowledge of that foe's contiguity engendered an idea of a danger to flee from, which became an instinct and thence an hereditary transmission,—he was indifferent, even disdainful, of the feeling of his comrades at his side; proud, confident in the midst of the great horde that, unaffected still, stood its ground. During that period there are numerous records of calves which, in the hunt or onslaught, having been left behind or become separated from the main body, and particularly from their own dams, were very easily, by simple means, attached to the destroyer of his maternal and paternal mainstay, and "blindly" following at the heels of the man-horse murderer, with all the same signs of affection they would show to their own dams. That trait was, surely, a strong one, indicating a strong nature or disposition, shaped and controlled in the most pronounced manner by environment; just as sure in captivity to be influenced by the subduing, gentling power of man when exerted on an immediate object and with certain kind solicitude, which was fully reciprocated in that object, as in nature to be influenced by the overcoming fierce, instincts of free environment, when that was provocative of suspicion and antagonism to their worst, latterly forced-on-them, natural enemy. Such calf-disposition was a strange concomitant; and for us it is a starting-point in that which makes us hope.

Indeed, when we come to investigate further, we find that even from the earliest times the great and ferocious American buffalo had been subdued, domesticated in fact, and even crossed with the farm bovine. This buffalo blood doubtless runs in the veins of a proportion of the common bovines of to-day as another "alloy," showing how easily his type could be absorbed.

When we press this point to its utmost we find that the buffalo is fully amenable to the domesticating process; and further that he demeans and conducts himself similarly and as truly as his more sedate and cooler-blooded bovine cousins. What is suitable to the one is suitable to the other.[1]

Leaving that most important point of domesticability, it might yet be objected that we would have no use for the species. Well, we assert that the buffalo, considering the conditions under which he has been reared—as seen and delineated by Catlin—on his native heath,[2] is far and away ahead of the common bovine as a beef animal, naturally fed. Compare this animal in his natural bisontine condition with the fleshless results among the bovines under the same conditions, in spring or at any period, on the former's prairie or the latter's ranche or range, and our assertion is at once borne out. This, remember, on "grass alone." Here, then, we have in the buffalo an animal exactly evolved out of his environment to fill the true American beef-producing animal's place, without any recourse to the tricks of shelter or winter fodder, as conceived by man for the benefit of a more cosmopolitan constructed bovine. We have gone far enough on these two lines to bring us to the great conclusions as to the buffalo necessary for our plea, viz:

1. His amenability to domesticity being perfect.
2. His economic value being incomparable.

[1] See article by the writer, "The American Buffalo: Its Past and Future," in the February number of *Baily's Magazine of Sports and Pastimes*. Vinton & Co., London, Eng.

[2] See Report of National Museum, 1886-'87, on "The Extermination of the American Bison," by William T. Hornaday.

II.

Having come to this most important conclusion, that in the American buffalo we have an animal superbly endowed by nature, not by artifice, to fill the bovine requirements of this country, made ready to hand, but his thorough adaptability unperceived or selfishly overlooked, we have now to consider the possibility of realizing our dream: *i.e.*, establishing his destiny as an animal of such utility as is proved he possesses. We can resign the old romance, but we can not risk the reality in so far as that can be preserved and enhanced. The buffalo, as he has been known, will be known no more. Established in the place his destinators would prepare for him, he will be an entirely different-natured—and even nurtured—being from that from which he was forcibly exiled; and, fulfilling the mission proposed for him, he will become greatly modified from the noble monarch of old. This is inevitable and consequent. We see the effect of the same treatment on the bovine species, which was also a wild species subdued at a comparatively recent period. Even the wild white cattle of Britain, kept in the parks from the earliest times, the most direct descendants of *Bos urus* (*primigenius*), are greatly modified from their ancestors by the restricted area and nature of their confinement. So it is with the truest representative of the buffalo in Europe, the Aurochs (*Bison priscus*) of the Lithuanian forests. But for all these instances we believe that in the buffalo of the future we shall, as the result of our judicious interference, our subduction and care, the resultant of his removal from his natural environment, see arise a new race thoroughly capable of enacting an undreamt-of career, and that with happier results than might formerly have been possible; for that former career of his was apparently doomed and destined to be sooner or later played out on the plains that witnessed his early glory.

We have now to consider the species as it is, for our purpose; its numbers and how composed. The following list gives the location of the different herds and numbers they contain, fit for breeding purposes, in the United States. The location simply is

given; further full particulars may be found in the elaborate report referred to in the note:

Location of Herd.	Number.
Garden City, Kan.,	115
Flathead Indian Reservation, Montana,	35
Clarendon, Texas,	13
Bismark Grove, Kan.,	10
Fort Bennet, Dak.,	9
Rapid City, Dak.,	4
Wood Lawn, Neb.,	5
Hamline, Minn.,	2
Glen Island, N. Y.,	4
Other places,	12
Wild West Show,	18
Public Park, Philadelphia,	10
" " Chicago,	7
" " Cincinnati,	4
" " New York,	4
" " Washington,	2
	254

For comparison we give the following figures to show the distribution of the entire number known:

Total captive, fit for breeding purposes in America,		254
Wild, under Government protection in Yellowstone Park,		200
Running wild unprotected:		
In United States,	85	
In Athabasca,	550	635
In foreign countries,		7
Total,		1096[8]

It will thus be seen that the number of those fit for breeding is only a fourth of the entire number. This number might

[8] See pp. 458, 525, of Mr. Hornaday's Report already noted.

possibly be added to in the future by new captures from the wild herds. Now, what do we propose to do with these remnants to preserve them from the surest forms of destruction that seemingly await them, if not carefully avoided: (*a*) in breeding, and (*b*) out-crossing? For there is just now as much danger from the latter as from the former.

We are not in the position of the "early improvers" of the bovine race; that is, of those who took it in hand within the last hundred years to rescue from a conglomerate promiscuity the various types of bovine excellence. By them in-breeding was necessary, essential, primarily, to establish the type. Their period of out-crossing had been going on during the centuries previous to the commencement of the improving period. But we have no type to establish; in fact, hardly any characteristics to improve; we have only to use those means of amelioration which captivity, that is, domesticity, brings. Therefore we, and it is fortunate for us, do not need to resort to the usual initial essential of in-breeding. But that is, nevertheless, the chief thing; in fact, with the limited alliances at our disposal, the main thing to avoid. And it is as to a means to avoid that, that the vital purpose of this paper is designed to deal.

The danger of out-crossing is the establishment of a mixed or bastard race of bisontine-bovines. The danger is real, but the means of avoiding the first danger—in-breeding—covers this.

With the alliances existing, what can be done to increase them, and not to circumscribe their area, not to bring their points of convergence too close? We have to widen these points as much as possible. Within the limits of the existing relationships—which are in reality just now sufficiently distant, that is, in so far as tracing to their common ancestors is concerned—we have to out-cross as much as possible. This would appear to be an easy matter to do, by the simple interchange of blood from one herd to another. But that, under existing conditions of ownership, and want of cohesion of breeders as a whole, would likely soon prove abortive. We have to look for some means of effecting cohesion and a unity of purpose and interest among owners and breeders.

Let us avail ourselves of the experience, now so well methodized, of our forebears, the pioneers of improvement among the gentler bovine races. Their rescue from common obliteration was the Herd Book, and, in Great Britain at least, every distinct breed has now its register. The latest established ones have, practically, been the means of rescuing from obliteration certain valuable races. We learn an important lesson from this.

But we imagine we hear a whisper: But we have so few to register. Patience! In collecting material for forming the foundation of such an undertaking, the number of the individuals composing such foundation, even in the largest bovine breeds, numerically fell short, we imagine, of the number of individuals we buffalo men possess. Besides, our individuals are absolutely pure, and all up to the highest standard. It was not so with the bovine races. We have therefore the advantage of our cousins. Our subject is, if such a register were initiated to-day, at a point that it took at least a quarter of a century for the bovine improvers to accomplish. Of course it must be admitted that the bovines did not, could not, start with the certainty of absolute purity, because of the mixing between races previous to the initiating of these registers. In that our bovines had an advantage over us, as it relieved them considerably of the greatest and immediate danger of in-breeding, which they were able thence to resort to, but which we have to avoid. Is such a register possible for the the buffalo? I think so. Let us see.

We start, we believe, with a larger "foundation stock," and absolute purity—no sub-standards—as compared with the bovines: the two desirable essentials. We should therefore obtain a complete record of all the male and female buffaloes fit for breeding. We should have their relationship to each other noted, traced, and arranged in systematic manner.

Whom would we look to to undertake this? We have the National Zoological Park, recently established at Washington from the very interest manifested in the "passing of the buffalo," for the purpose of providing a receptacle for the remains of this noble representative of American fauna, and resuscitating it from total or immediate obliteration. As therefore such was the

origin of this National Park, we would put the matter under the superintendence of its accomplished Director, Mr. W. T. Hornaday, to whom our mutual friend, the buffalo (what remains of him) owes so much, to organize such a register for the regeneration of the bison, with such help as the Government could supply that would be necessary.

Such a register should have entered therein, in systematic manner, and with such full details as could be obtained, the history of each remaining herd and each male and female individually composing it. An inspector of the herds might be advantageously appointed to collect such matter on the spot. The initial entries at least should be free of charge; and such points as the following might be recorded:

1. Location of herd.
2. As near as possible, age, place of birth, or capture, of the original members of the herd.
3. Affidavit of purity.
4. For each younger member of the herd, sire and dam grandsire and granddam, if necessary.
5. Description, according to a schedule of details, with photographs if possible.
6. Nomenclature to be governed by the proverb that "brevity is the soul of wit," that is, each individual entry to be named; the name to be short and of one word. Indian names would be most appropriate, or such short names as have a direct connection with the subject.
7. Pedigree to rank through the side of the dam, which establishes the best means of afterwards tracing each succeeding entry, especially of sires.
8. As an appendix, a bibliography of the subject would be useful.

Such a register would make a handsome and highly interesting volume. Distributed among the breeders, they, sending in constant, periodical reports, would become generally and specially bound together in one great united experiment. From this intercourse and correspondence of the whole, judicious interchanges could be continuously made from time to time, and the process

and results of breeding constantly watched and guarded. Breeders, being bound by a common interest, would have the best means at their disposal of avoiding the fatal extermination of their herds, from an insufficient knowledge—without this source of intelligence—by too dangerous in-breeding. The register would supply them with the means of avoidance, the power of tracing to divergence the relationships of the sires and dams of stock for which they might desire to interchange. Thus divergent lines of relationships would be established, instead of their breeding to a convergent point, so that a broadening foundation would be obtained. Then the American buffalo would take rank as the true, because indigenous, beef ruminant, and have its place alongside the proudest breed of bovines in existence.

Thus the two fatal possibilities of (1) crossing-out, and (2) breeding-in, which must ever menace the uncertain existence of the buffalo, without such a method of prevention, would be entirely avoided. No better method than the one herein advocated can we conceive for the purpose designed than the register. The number of separate herds that such a register would develop would be vitality itself to "the breed." I think I hear this entire proposal scouted at as bold and chimerical. But this there can be little doubt is about the only chance left for rehabilitating the species as a whole. Breeding would then become a fine art; and it would put the undertaking on a lasting financial and commercial basis.

ORIGIN OF THE PLANE-TREES.

BY LESTER F. WARD.

THE fourth number of Volume XI. of Engler's *Botanische Jahrbücher* contains an elaborate article by Johann Jankó, entitled "Abstammung der Platanen." The writer treats the subject in the characteristic German fashion, approaching it in an exhaustive manner from every possible point of view; and his contribution throws much light upon this interesting type of plant life. He had thoroughly prepared himself by careful observations continued during a number of years, and by collections, made at different and critical seasons of the year, from all the species of Platanus growing wild or in cultivation in Europe. He had also carefully studied the fossil forms, apparently only from the published figures, and evinces a wide acquaintance with these as well. He makes a searching revision of the species, both living and fossil, reducing the former to three, with numerous varieties, and the latter to eight.

The object of the paper, as indicated by its title, is to derive the living species from the fossil ones, and to show the line of descent of the former. The title is, nevertheless, misleading, since it would imply that the author was seeking the origin of the genus itself. So far is he from this that he rules out of the genus all the archaic forms occurring in the earlier formations, including *P. nobilis* of Newberry, and gives no intimation as to whether he regards them as ancestors of Platanus.

The following is his disposition of the fossil species:

With *P. aceroides* (Göpp.) Heer, he unites: *P. aceroides cuneifolia* Gaudin, *P. cuneifolia* Göpp., *P. ettingshauseni* Mass., *P. gracilis* Ett., *P. grandifolia* Ung., *P. œynhauseniana* Göpp., *P. pannonica* Ett., *P. rugosa* Göpp., *P. sterculiæfolia* Ett., *Acer ficifolium* (Viv.) Brongn., *A. heerii* Mass., *A. heerii deperditum* Mass., *A. heerii ficifolium* Mass., *A. heerii productum* Mass., *Acer heerii tricuspidatum* Mass., *A. heerii trilobatum* Mass., *A.*

productum Al. Braun., *A. pseudocreticum* Ett., *A. tricuspidatum* Al. Braun, *A. tricuspidatum subintegerrimum* Al. Braun., *A. trilobatum* (Sternb.) Al. Braun., *A. trilobatum genuinum* Engelh., *A. trilobatum patens* Al. Braun., *A. trilobatum productum* Al. Braun., *A. trilobatum tricuspidatum* Al. Braun., *Acerites deperditum* Mass., *A. ficifolius* Viv., *A. incerta* Mass., *Cissus platanifolia* Ett. *Quercus platanoides* Göpp., *Q. rotunda* Göpp.

He regards *Platanus academiæ* Gaud., *P. dissecta* Lx., and *P. appendiculata* Lx. as varieties of *P. aceroides* Göpp., the last two as identical.

To *P. gulielmæ* Göpp. he refers *P. aceroides* var. Heer, from Greenland.

He recognizes *P. marginata* (Lx.) Heer, the *Viburnum marginatum* of Lesquereux's earlier works, as a true Platanus.

He considers *P. heerii* Lx. a variety of *P. primæva* Lx.

He excludes from the genus Platanus the following: *P. affinis* Lx., *P. digitata* Ung., *P. diminutiva* Lx., *P. dubia* Lx., *P. hercules* Ung., *P. jatrophæfolia* Ung., *P. latiloba* Newb., *P. nobilis* Newb., *P. obtusiloba* Lx., *P. recurvata* Lx., *P. sirii* Ung.

A number of these have been, of course, long ago abandoned; but of the American forms, *P. diminutiva*, *P. nobilis*, *P. obtusiloba*, and *P. recurvata* had not been hitherto challenged.

He ignores the following species: *P. antiqua* Watelet, *P. aspera* Newberry, *P. basilobata* Ward, *P. borealis* Caspary, *P. dubia* Watelet, *P. heterophylla* Newberry, *P. klebsii* Caspary, *P. papilloni* Watelet, *P. subintegra* Göpp.

Watelet's species were so imperfectly figured and characterized that little could be said of them, and he was perhaps justified in passing them by unnoticed. Still less was he called upon to take account of those of Caspary and Newberry, and the last one on the above list, none of which have, to my knowledge, ever been figured. He was entirely unacquainted with the works of the present writer in which *P. basilobata* has been made known, viz., the "Synopsis of the Flora of the Laramie Group," "Types of the Laramie Flora," and "Paleontological History of the Genus Platanus." The last-named paper was sent to him as soon as his address could be found, and he has acknowledged it, and sent in

return a reprint of his paper, together with other works of his. In his letter of acknowledgment he expresses a deep interest in the subject of basilar lobes, but does not say whether he accepts my interpretation of their significance. *P. basilobata*, as I have pointed out, is so closely related in other respects to *P. nobilis*, that but for this feature I should have included it in that species; and Sir William Dawson, who had already figured it from the Canadian Laramie as *P. nobilis*, has, in his Geological History of Plants, proposed to call it *P. nobilis* var. *basilobata*. Prof. Jankó would therefore naturally have affixed to this species, as to *P. nobilis*, his sweeping verdict, "non est Platanus."

But the question, as it seems to me, is not so much whether these aberrant forms really belong to the present genus Platanus, as strictly limited by the characters presented by the few surviving species of that ancient type, as whether they represent the ancestors of these modern forms. The genus Platanus, like its close relative Liquidambar, like the monotypic Liriodendron, and like those holding-over forms of coniferous trees, the Sequoia and the Ginkgo, presents all the indications of being the last of a long lineage, and paleobotany, in this as in the other cases named, shows that it was once far more abundant than at present. So prominent a group must have had an ancestry, and the archaic forms found in the American Cretaceous deposits bear evidence of constituting that ancestry.

One of the distinctive links in this chain of evidence proves to be the presence of basal lobes. Nearly effaced in the latest living type, *P. orientalis*, this feature, nevertheless, sometimes occurs there, and was actually found by the searching observation of Professor Jankó, who, without the slightest suspicion of its significance, but true to his instincts of describing everything he found, described it in the following language: "Den Blattgrund betreffend, fand ich bei *P. orientalis* einen sehr interessanten Fall, dessen ganze Entwickelung ich beobachten konnte und welcher als Uebergangsform von der lappigen in die schildförmige betrachtet werden kann. Bei jenen Blättern nämlich, wo der Ausgangspunkt der drei oder fünf Hauptnerven nicht an der Grenze von Stiel und Spreite ist, vergrössert sich nicht selten der letzte Zahn,

mit welchem der Blattrand den Stiel berührt, und streckt sich mehr vor als die übrigen Zähne des Blattgrundes. An den inneren Rändern dieses Zahnes entsteht mit der weiteren Entwickelung ein zweiter Zahn, und beide erscheinen schon als kleine selbständige Lappen; wenn nun deren Grösse so lange wächst, bis diese zwei kleinen Seitenläppchen an einem Punkte sich berühren, so beginnt das Wachstum von diesem Punkte aus nach unten, und dieser Teil der Lamina ist nicht mehr an den Stiel gewachsen, sondern sondert sich von ihm ab. Dieses Läppchen ist manchmal ziemlich gross und kann im Allgemeinen als Resultat einer progressiven Entwickelung betrachtet werden."

I have never found it in that species as introduced into our American parks, where care is taken to trim out the sprouts and low branches on which it would occur, if at all. Fig. 1 represents a typical leaf of that species. But in the American form *P. occidentalis* in its wild state, especially on those abundantly nourished shoots of the season that spring from the base of stumps where the trees have been felled, I have for years observed it in all its phases, and studied its many curious transitions. These I have described, and have figured some of them in the papers mentioned, to which I would respectfully refer the reader.

In the original paper which I read before the Biological Society of Washington on February 20, 1886, I exhibited some forms that better illustrate the phenomenon than any that have been published. One of these I had figured, and sent the drawing, together with others and the paper itself, to one of the editors of the AMERICAN NATURALIST, at his request, for publication in that journal; but unfortunately it did not appear, owing to a change that took place in the publishers of the NATURALIST just at that time, in the course of which my manuscript was mislaid and could not be found. It has recently come to light and been returned to me, and I am able to introduce here (Fig. 2) the figure in question.

In view of the importance of the basilar expansions above mentioned, and of the fact that Professor Jankó excludes such forms as *P. nobilis* from the genus Platanus, I may perhaps be permitted, at the risk of some repetition of what has been said in my previous

paper, to introduce here that part of my original paper relating to these forms, inasmuch as I there dwelt upon them considerably more at length.

"Few as are the living representatives of this genus, it is now known that the type played an important rôle in later geologic time. More than twenty fossil species have been described, the greater part of which are from North American or Arctic strata. The American forms mostly occur in what is called the Laramie group, which all agree to place very near the boundary line between the Cretaceous and the Tertiary formations. The European, Arctic, and many of our western forms agree well enough with living species to leave no room for doubt as to their generic affinities, but in the Laramie group there occur some aberrant forms which have led to serious difficulties. The most notable of these is the *Platanus nobilis* of Newberry, from the Fort Union deposits. Our knowledge of this species is as yet confined to what we have been able to derive from the study of a large number of very fine leaf impressions. The leaves differ in some important respects from those of any living species of Platanus. They are usually very large, often measuring over a foot in length and width, and instead of having numerous short pointed lobes with broad sinuses, they have only three, or at most five, lobes, which are large and separated by acute sinuses, the margins being entire, or only slightly undulate-toothed. These characters give them much the aspect of many species of Aralia, and they possess other points of resemblance to that genus. They also have the general form of the three-lobed leaves of sassafras. Among the numerous specimens of this type collected by me on the Lower Yellowstone, in 1883, there is great variety in size, coupled with marked uniformity of shape and nervation. The smaller specimens agree in all essential respects with the *Aralia notata* of Lesquereux (Tertiary Flora, p. 237, Pl. XXXIX., Figs. 2-4), from Colorado and Wyoming, which he first called *Platanus dubia* (Hayden's Annual Report, 1873, p. 406) [Fig. 1 of my former paper (Proc. Nat. Mus., Vol. XI., 1888, Pl. XVII.)].

"In immediate association with *Platanus nobilis*, and perhaps merely as a state of it, there occurred a form differing chiefly in

the possession of a very remarkable appendage at the base of the blade. This appendage seems to constitute a miniature reflex of the leaf itself, projected backward over the petiole as a lobate expansion. It is palmately nerved like the principal blade, the primary nerves entering the lobes. These sometimes differ in number from those of the leaf, amounting to six in two of my specimens. They also vary considerably in length and shape. [See Figs. 2-5 of the paper last cited.]

"This basilar appendage is extremely interesting. It is not stipular, since it arises from the summit of a petiole of considerable length, six centimetres of it being preserved in one specimen without showing the attachment. Neither is it bracteal, and there seems no way but to regard it as a veritable part of the main blade, to which it is joined by a broad neck of parenchymatous tissue.

"There is good reason to regard this character as an argument in favor of referring these leaves to Platanus rather than to Aralia or any other genus. The leaves of Platanus have a tendency to produce appendages of various kinds. A good illustration of this is seen in the interesting *P. appendiculata* Lx., from the auriferous gravels of the Sierra Nevadas [Fig. 8 of that paper], where the generic affinities are not at all in doubt. But here the appendages appear to be stipular, though large and quite near to the base of the limb. In the sycamore of this country the stipules are prominent, and often lobed and nerved much like these appendages. They also often appear at the base of young branches bearing several leaves which are likewise provided with true stipules of the same form. In addition to this, however, there sometimes occurs a true basilar lobe or wing-like expansion on the leaf itself, which in the more marked examples very closely resembles those of the fossil impressions described. [Fig. 2 of the present paper represents such a case, and also shows the stipules as they are often produced.] Long before I had seen the fossil leaves I had remarked this tendency in *P. occidentalis* to develop such basilar appendages, and I had collected and preserved specimens of the leaves that bore them to illustrate this peculiarity.

"A careful study of these expansions leaves no doubt of their strict homology with those so much more prominently shown in the extinct form, and the conclusion is at least natural that they are the surviving vestiges of a once prevalent organ.

"Assuming the fossil form to be distinct from *P. nobilis*, which is, however, by no means certain, I have ventured to name it from the peculiar character above described, and to call it *P. basilobata*."

The close relationship of *P. basilobata* to *P. nobilis* renders it obvious that the two must stand or fall together as representatives or ancestors of the genus Platanus. Moreover, it would seem that if they are to be excluded the whole series of ancient types to which they belong, must be removed from the ancestral line of descent of the surviving forms. It appears, therefore, to be essential to the argument that the question whether they belong to this line be settled at the outset. We will, therefore, consider Professor Jankó's objections to the platanoid nature of *P. nobilis*. These are, first, that "It has five thick primary nerves (in a geological period in which this character is wanting in all), and from these very many (16-18) strong secondaries proceed parallel to one another without ending in teeth, their ends, however, reaching the margin of the blade; moreover, these secondaries are well developed to the base of the primaries, which does not occur in the corresponding forms of Platanus." In the second place, "The leaf is five-lobed at the beginning of a geological period in which this form does not occur in the planes; moreover, the lobes are very well developed and large, the depth of the sinuses is of the third degree, although this depth does not appear until the end of the Miocene, and is not characteristic even in the Pliocene." Finally, he objects that "The margin of the leaf of *P. nobilis* is undulating and not toothed; whereas, in the planes in which the nervation is developed as it is in that species, either teeth appear, or the margin is entire, in which latter case the secondaries converge over one another."

In reading these statements one naturally wonders from what source Professor Jankó has derived his knowledge of this species. The chief objection seems to be that the leaves are five-lobed,

with three lateral primaries. This is not at all the case. The original figure of Dr. Newberry (Illustrations of Cretaceous and Tertiary Plants, Pl. XVII.) shows at most only four lobes, and one of these is produced by an abnormally strengthened secondary arising out of one of the lateral primaries. In Dr. Newberry's description (Later Extinct Floras of North America, Ann. Lyc. Nat. Hist., Vol. IX., p. 67) he says: "Leaves . . . three-lobed, or sub-five-lobed, . . . two basilar nerves of nearly equal length and strength," etc.; and speaking of the secondaries arising from the lateral primaries: "The second or third one on each side is often much the strongest of the series, and is then prolonged into a small but distinct lateral, triangular, acute lobe, giving the leaf a somewhat pentagonal form." He figured only one of the leaves in his collection in which, as above stated, this strong secondary and supplementary lobe occur only on one side. From his description it is inferred that although this sometimes may occur on both sides, it is more frequently wanting entirely, and the leaves are simply three-lobed. They never have more than three primary nerves.

The large specimen figured by me (Types of the Laramie Flora, Pl. XVI.) is of this latter form, and the greater number of my specimens, and of all those seen by me (amounting to hundreds), belong to this class. It is, therefore, safe to say that *P. nobilis* has essentially a palmately three-lobed leaf with two lateral primaries.

So much for the general form. Next, with regard to the margins and the disposition of the secondaries. It is true that in Dr. Newberry's figure (the specimen I have not seen) the secondaries pass directly to the margin, and each one enters a very short, broad, and obtuse tooth, giving the margin an undulate rather than a dentate character. But this undoubtedly varies in different specimens, for he describes the secondaries as "terminating in the teeth of the margin." In my specimens there is the greatest diversity in the margins and in the behavior of the secondaries on approaching them. In the one figured in the "Types," these do not generally differ from Dr. Newberry's, although the secondaries are not all straight or parallel. But I

have other specimens, which will be published in my "Monograph of the Flora of the Laramie Group," in which there are all the variations from a sharply toothed margin with the secondaries entering the teeth, to an entire margin with the ends of the secondaries curving and arching over one another (camptodrome). Moreover, these differences sometimes occur in different parts of the same leaf. In my *P. basilobata*, so far as now known, the nervation is always camptodrome, and the leaves strictly three-lobed.

It may be well to point out in this place more specially than I have done hitherto that the characters last considered not only bear directly upon the ancient forms of the Cretaceous referred to Sassafras or Araliopsis, but also connect themselves with some of the living species, thus strengthening the argument that *P. nobilis* and *P. basilobata* form a sort of connecting link between these. Leaves of *P. racemosa*, for example, sometimes have very much the same form and general nervation of *P. nobilis*. Fig. 3 represents such a leaf now in the National Herbarium, even showing the one strengthened secondary producing a lobe similar to that of Dr. Newberry's figure. Otherwise it is true that the secondary nerves are different, but they are approached in some forms of *P. basilobata*.

On the other hand, there is much variation in these respects among the Cretaceous forms referred by Lesquereux and Newberry to Sassafras. The margins of the lobes are generally entire, as in the leaf which I reproduced from the Cretaceous Flora (Pl. XII., Fig. 2, of the former paper); but there are others, as, for example, that shown in Fig. 4 of the present paper, reproduced from Pl. XI., Fig. 1, of the same work, in which several of the outer secondaries terminate in teeth precisely as they do in *P. nobilis*.

It remains to consider Professor Jankó's argument from the geological history and distribution of the fossil species. This is the weakest part of his paper, as the ancient forms are so largely American, and American geology is so little understood in Europe. So far as fossil plants are concerned, it is chiefly known to Europeans through the works of Lesquereux, who never pre-

tended to be a geologist, and was led by the resemblance in the fossil floras, without taking account of other kinds of evidence, to place most American plant-bearing deposits too high in the series. Why, for example, should Europeans continue to follow Lesquereux in calling the Laramie group Tertiary, when King, Hague, Emmons, Powell, Cope, Marsh, and almost everybody else, have always called it Cretaceous? Moreover, I have shown in my "Synopsis of the Flora of the Laramie Group," published in the Sixth Annual Report of the U. S. Geological Survey, that the evidence of the fossil plants does not necessarily conflict with the latter view, and that the idea that it does so conflict arises from two causes: First, lack of attention to the character of the Upper Cretaceous floras already known; and secondly, the all embracing predominance of the Miocene flora of Europe, in which it is possible to find surviving types of the Cretaceous flora, and, indeed, almost anything that it is desired to find.

Again, Professor Jankó does not seem to be aware that most or all of the Tertiary plant-bearing deposits of the Arctic and sub-Arctic regions which Heer classed as Miocene are regarded as Eocene by those who are now chiefly devoted to their study. Heer's fallacy was also two-fold. Not only was he led astray by the abundance of the Miocene flora to which, as developed in Switzerland, he had devoted so much of his life, but he also failed to make sufficient allowance for the effect of high latitude in causing a flora to appear more recent than it is, as has been chiefly pointed out by Gardner.

The geological distribution of the fossil species according to Jankó, employing his own nomenclature with its exclusions, is as follows:

Cretaceous.—*P. primæva, primæva heerii*, and *newberryana*.

Eocene.—*P. rhomboidea, raynoldsii, haydenii*, and *gulielmæ*.

Miocene and Pliocene.—*P. aceroides, aceroides academiæ, aceroides dissecta, gulielmæ*, and *marginata*.

He does not specify localities, and thus leaves the botanical reader to infer that all these statements are of equal geological weight, which is far from being the case. In fact, for reasons already given and many others, a large part of the whole argu-

ment from geology is erroneous. Let us look closely for a moment at the real geological and geographical distribution of the fossil species of Platanus, especially the American species.

P. primæva Lx., is correctly referred to the Cretaceous, as it occurs only in the Dakota group of the United States.

P. primæva heerii Jankó (*P. heerii* Lx.) is also primarily a Dakota group species, but occurs in the Mill Creek series of Canada and in the Atane beds of Greenland, both of which are considered equivalent to the Cenomanian of Europe, and therefore not greatly different in age from the Dakota group. But I found a form at Black Buttes in the typical Laramie which I referred to that species, admitting some differences. Professor Lesquereux, who was very tenacious of his views as to the Tertiary age of the Laramie, challenged, in a letter, my determination, and I am not quite certain that it is correct. It may be as near to another Cretaceous species, *P. newberryana*, but it is not near to any Tertiary species. But *P. heerii* is not confined to the Cretaceous and Laramie if Gardner is right in reporting it from the Island of Mull at Ardtun, the Eocene age of that celebrated deposit being well established. On this point, however, there are doubts, as he only provisionally identifies the *Platanites* of Forbes with that species.

P. newberryana Heer, the other Cretaceous species, is, like the rest, a typical Dakota group form, and has not been found outside the Cretaceous, nor, indeed, outside the Dakota group, except in the Patoot beds of Greenland, which, however, are considerably higher in the series, being referred by Heer to the Senonian.

So much for the Cretaceous species. Next as to the alleged Eocene ones.

P. rhomboidea Lx. is only known in two specimens from Golden, Colorado. An examination of the specimens themselves shows that they are from the so-called tufa beds of South Table Mountain, and therefore belong to the Denver formation of Emmons, which he places somewhat higher than the Laramie. It may therefore pass as Eocene.

P. raynoldsii Newberry was originally described from the Fort Union group on the Missouri and Yellowstone Rivers, and I

found it in the Yellowstone Valley in 1883. The Canadian geologists report it from numerous points in what they call Laramie in the Northwest Territory, which I believe to be nearly or quite the same as the Fort Union group. As Dr. Newberry is not willing to admit the Laramie age of this group, and inclines to regard it as Tertiary, this may also pass as an Eocene species. It is not, however, strictly confined to the Eocene, for it has recently been found in a collection from the John Day River, Oregon, a Tertiary deposit that is generally placed near the top of that system as Pliocene or extreme upper Miocene. On the other hand, the variety *integrifolia* Lx. is a Laramie form from Black Buttes and Golden, and is therefore Cretaceous.

P. haydenii Newberry has very much the same range as the last, chiefly Fort Union group and Canadian Laramie, but it has not been found higher, and has been reported from certain doubtful deposits, such as Carbon, Medicine Bow, and Washakie, in Wyoming. It also occurs at Golden, and is said to be found in the typical Laramie of the Raton Mountains.

P. gulielmæ Göpp. is a well-known and widely distributed species of the European Miocene, also abundant in all the Arctic Tertiaries. Nathorst finds it in the Upper Tertiary of Japan, and it is by no means rare in the American deposits, being reported from Carbon, Washakie, Separation, Medicine Bow, Junction Station, etc., in Wyoming, perhaps Lower Tertiary; from Golden, probably Denver formation; and with less certainty from Black Buttes and the Raton Mountains, true Laramie. I collected it on the Lower Yellowstone, Fort Union group, and Lesquereux identified it in a collection from Mansfield, Louisiana (Mississippi Tertiary). It therefore appears to originate in the Upper Cretaceous.

Finally the Miocene and Pliocene species are.

P. aceroides (Göpp.) Heer. This is the most abundant of all fossil planes, and, accepting Professor Jankó's synonymy, is extremely variable. It is doubtless the immediate ancestor of all the living species, but it is not an exclusively Miocene and Pliocene species, as it occurs abundantly throughout the Arctic

Tertiaries, and in the Fort Union group and other deposits in the United States that are below the Green River group, and have been sometimes regarded as Laramie. If Tertiary at all, they belong at the very base of that series. Specimens have even been collected in the Bozeman coal mines, which Dr. Peale, who has devoted many years to their study, regards as Cretaceous. In the form of *Acer trilobatum*, which Lesquereux did not consider a Platanus, it also occurs in the Green River group on Troublesome Creek, Colorado, generally regarded as Eocene. It, therefore, doubtless also had its origin in the Cretaceous of America.

P. aceroides academiæ Jankó (*P. academiæ* Gaudin) is only known from the Upper Miocene deposit of Montemasso, Italy, and has no importance.

P. aceroides dissecta Jankó, including *P. dissecta* Lx., and *P. appendiculata* Lx., is confined, so far as now known, to the Upper Tertiary (Pliocene or Quaternary) of California (Chalk Bluff, Corral Hollow, Spanish Peak, Toulumne and Nevada Counties). The latter form, as I have shown, approaches very closely the American sycamore, *P. occidentalis*, and connects it by its basilar appendage with *P. basilobata* of the Fort Union group.

P. marginata (Lx.) Heer (*Viburnum marginatum* Lx.), the last species to be considered, is primarily a typical Laramie (Bitter Creek) species, but also occurs in the Denver formation at Golden, Colorado. Like so many other Laramie species, it is found in the Tertiary deposits of Greenland, where Heer first discovered its platanoid character. It is, therefore, not a Miocene species at all, but a Cretaceous species extending into the Eocene.

This hasty review enables us to revise the geological distribution of the fossil species of Platanus given by Professor Jankó, which should therefore stand as follows:

I. Exclusively Cretaceous species.—*P. newberryana* and *primæva*.

II. Species originating in the Cretaceous, but extending into the Tertiary.—*P. primæva heeri*, *marginatum*, and *raynoldsii integrifolium*.

III. Species originating in the Eocene.—*P. aceroides, gulielmæ, haydenii, raynoldsii,* and *rhomboidea.*

IV. Species not occurring below the Miocene.—*P. aceroides academiæ* and *aceroides dissecta.*

It will be observed that in the above distribution I have not considered the Fort Union group, the Denver formation, nor any of the deposits along the Union Pacific Railroad, except those on Bitter Creek, to be Cretaceous. I have also excluded the Bozeman coal mines containing *P. aceroides.* The radical difference between this distribution and that of Professor Jankó renders needless any discussion of his argument from geological considerations; and although I believe an argument can be based on these considerations, it would require to take into the account the more abnormal and archaic forms which he excludes from the genus. This argument is already stated in my previous papers, and the present one has become too long to admit of its expansion here.

EXPLANATION OF PLATE XXVIII.

FIG. 1.—Leaf of *Platanus orientalis* L., from Washington, D.C. (cult.).

FIG. 2.—Lower portion of a leaf of *Platanus occidentalis* L., showing basilar and stipular appendages, from the District of Columbia.

FIG. 3.—Leaf of *Platanus racemosa* Nutt., from California, collected by Mrs. Austin.

FIG. 4.—*Sassafras cretaceum* Newb., Lesquereux, Cretaceous Flora, Pl. XI., Fig. 1. Dakota group.

PLATE XXVIII.

Platanus species.

RECORD OF AMERICAN ZOOLOGY.

BY J. S. KINGSLEY.

(Continued from Vol. XXIV., page 548.)

IT is the intention to catalogue here in systematic order all papers relating to the Zoology of North America, including the West Indies, beginning with the year 1889. An asterisk indicates that the paper has not been seen by the recorder. Owing to the method of preparation it is impossible to collect in one issue all the papers relating to any group, but it is hoped that succeeding numbers will correct this. Authors are requested to send copies of their papers to J. S. Kingsley, Lincoln, Nebraska.

GENERAL.

RILEY, C. V.—On the causes of variation in organic forms. Proc. A. A. A. S., XXXVIII., p. 225, 1889.

COCKERELL, T. D. A.—On the citation of localities. *Can. Ent.*, XXI., p. 46, 1889.

HOUGH, W.—The preservation of museum specimens from insects and the effects of dampness. Rep. U. S. Nat. Mus., 1886–7, p. 549, 1889.

HERRICK, F. H.—Walks under the sea by a coral strand. AM. NAT., XXIII., p. 941, 1889 [1890].

COPE, E. D.—The Silver Lake of Oregon and its region. AM. NAT., XXIII., p. 970.

RYDER, J. A.—The acquisition and loss of food-yolk, and the origin of the calcareous egg-shell. AM. NAT., XXIII., p. 928, 1889 [1890].

PROTOZOA.

STOKES, A. C.—Notices of new Peritrichous Infusoria from the fresh waters of the United States. *Jour. Roy. Micros. Soc.*, 1889, p. 477, 1 pl.—Describes as new *Epistylis vittata*, *E. elongata*, *E.*

autumnalis, E. ramosa, Pyxidium nutans, Vorticella conosoma, V. conochili, V. molesta, Opisthostyla globularis, O. similis, Halsis [nov. gen.] *furcata.* As in all of Dr. Stokes's papers, no localities are given.

SPONGES.

* Von Lendenfeld, R.—A monograph of the horny sponges. London Royal Society, 1889.—Describes 56 species from the Atlantic coasts of North America, of which 29 also occur in Australia.

Fewkes, J. W.—Rosella in shallow water near Monterey, Cal. Proc. Boston Soc., XXIV., p. 45, 1889.

CŒLENTERATA.

Fewkes, J. W.—On a method of defense among certain medusæ. Proc. Bost. Soc., XXIV., p. 200, 1889.

Von Lendenfeld, R.—Neuere Untersuchungen über Polypomedusen. *Biol. Centralbl.*, IX., p. 47, 1889.—Abstracts of papers by Brooks, H. V. Wilson, Fewkes, *et al.*

Nutting, C. C.—Contribution to the anatomy of Gorgonidæ. Bull. Lab. Nat. Hist., State Univ. of Iowa, I., p. 97, 10 pls., 1889. —A general account.

Fewkes, J. W.—New invertebrata from the coast of California. Bull. Essex Inst., XXI.. p. 99, 8 pls., 1889 [1890].—Describes as new *Syncoryne occidentalis, Campanularia occidentalis, Atractylodes* [n. g.] *formosa, Perigonimus formosus, Steenstrupia occidentalis, Willia occidentalis, Microcampana* [n. g.] *conica, Velella meridionalis, Athorybia californica, Sphæronectes gigantea, Bunodes californica, Anemonia stimpsonii;* and gives notes on *Syncoryne rosaria, Polyorchis penicillata, Chrysaora melanaster, Aurelia labiata, Pelagia panopyra.*

——The anatomy of *Astrangia danæ.* 20 pp., Washington, 1889.—Six plates drawn by Sonrel in 1849. Explanation by Fewkes. Published by Smithsonian Institution.

——On a new Athorybia. *Ann. and Mag. Nat. Hist.*, III., p. 207.—*A. californica.*

——On Angelopsis and its relationship to certain Siphonophora, *ibid*, 1889.

ECHINODERMATA.

IVES, J. E.—On a new genus and two new species of Ophiurans. Proc. Phila. Acad., 1889, p. 143.—*Ophiocrinus granulosus* and *Ophioglypha lockingtonii*, from the Pacific coast of America.

——Catalogue of the Asteroidea and Ophiuroidea in the collection of the Academy of Natural Sciences of Philadelphia, *l. c.*, 1889, p. 169.—Contains some new localities.

FEWKES, J. W.—On the serial relationship of the ambulacral and adambulacral calcareous plates of the star-fishes. Proc. Bost. Soc., XXIV., p. 96, 1889.

——New invertebrata from the coast of California. Bull. Essex Inst., XXI., p. 99, 7 pls., 1889 [1890].—Notes on *Dermasterias imbricata* and *Ophiothrix rudis*.

PLATHELMINTHES.

LINTON, EDWIN.—Notes on cestoid entozoa of marine fishes. *Am. Jour. Sci. and Arts*, XXXVII., p. 239, 1889.—Abstract of forthcoming paper.

STEDMAN, J. M.—Researches on the anatomy of *Amphistomum fabaceum* Diesing. Proc. Am. Soc. Micros., XI., p. 85, 3 pls., 1889.—A histological account of this parasite of the manatee.

ANNELIDS.

FEWKES, J. W.—New invertebrata from California. Bull. Essex Inst., XXI., p. 130, 1889 [1890].—Describes as new *Sabellaria californica*, *Sabella pacifica*, *Spio californica*.

MARSH, C. D.—A two-tailed earthworm. AM. NAT., XXIV., p. 373, 1890.

PROSOPYGII.

FEWKES, J. W.—New invertebrata from the coast of California. Bull. Essex Inst., XXI., p. 135, 1889 [1890].—Describes as new *Ascorhiza occidentalis* (vide infra).

——A preliminary notice of a stalked Bryozoan (*Ascorhiza occidentalis*). *Ann. and Mag. Nat. Hist.*, III., p. 1, 1889.

HINCKS, T.—The Polyzoa of the St. Lawrence: a study of Arctic forms. *Ann. and Mag. Nat. Hist.*, III., p. 424, 1889.

DALL, WM. H.—A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States. Bull. U. S. Nat. Mus., No. 37, 1889.—Enumerates 21 forms.

——Preliminary report on the collection of Mollusca and Brachiopoda obtained [by the U. S. Fish Commission steamer Albatross] in 1887-8. Proc U. S. Nat. Mus., XII., p. 219, 1889 [1890].—See AM. NAT., XXIV.

ROLFE, C. W.—Characters and distribution of the genera of Brachiopods. AM. NAT., XXIII., p. 983, 1889 [1890].

VERMES, INCERTÆ SEDIS.

ZELINKA, C.—Die Gastrotrichen. *Zeit. wiss. Zool.*, XLIX., p. 209, 1889.—See AM. NAT., XXIII., p. 912.

MOLLUSCA.

FORD, JOHN.—Remarks on *Oliva inflata* [etc.]. Proc. Phila. Acad., 1889, p. 137.—On the variation of the Olivas.

DALL, W. H.—On the hinge of the Pelecypods and its development, with an attempt toward a better subdivision of the group. *Am. Jour. Sci. and Arts*, XXXVIII., p. 444, 1889.—Criticises existing classifications of Lamellibranchs, and proposes one based primarily on hinge structure. Vide AM. NAT., Dec. 1889.

FORD, J.—Notes on Crepidula. Proc. A. N. S., Phila., 1889, p. 345, 1890.—Maintains specific validity of *C. glauca*.

SHARP, B.—Activity in *Donax*. Proc. A. N. S., 1889, p. 347, 1890.

PILLSBRY, H. A.—New and little-known American Mollusks, II. Proc. A. N. S., Phila., 1889, p. 411, 1890.—Describes as new *Pupa calamitosa* (Cal. and Lower Cal.), *P. sterkiana* (L. Cal.), *Zonites simpsoni* (Ind. Ter.), *Z. selenitoides* (Cal.), *Helix* (*Hemitrochus*) *streatori* (West Indies), *Pupa holzingeri* Sterki (Iowa, Minn.).

DALL, W. H.—Preliminary report on the collection of Mollusca and Brachiopoda obtained [by the U. S. Fish Commission steamer Albatross] in 1887–8. Proc. U. S. Nat. Mus., XII., p. 219, 1889 [1890].—See AM. NAT., XXIV., p. 582.

Heilprin, Angelo.—On some new species of Mollusca from the Bermuda Islands. Proc. Phila. Acad., 1889, p. 141, 1 pl.—Describes as new *Chama bermudensis*, *Macoma eborea*, *Mysia pellucida*, *Cytherea penistoni*, *Emarginula dentigera*, *E. pileum*, and *Cæcum termes*.

Pillsbry, H. A.—Nomenclature and check-list of North American land shells. Proc. Phila. Acad., p. 191, 1889.—Enumerates 302 species.

Dall, W. H.—Notes on the anatomy of *Pholas* (*Barnea*) *costata* Linne., and *Zirphæa crispata* Linne. Proc. Phila. Acad., 1889, p. 274.

Wright, B. H.—A new Florida Bulimulus. *W. A. Scientist*, VI., p. 8.—*B. hemphillii.*

Peck, J. J.—On the anatomy and histology of *Cymbuliopsis calceola.* Studies Biol. Lab. J. Hopkins Univ., IV., p. 335, 1890.—Describes digestive, nervous, reproductive, excretory, and circulatory organs.

Fewkes, J. W.—New invertebrata from the coast of California. Bull. Essex Inst., XXI., p. 139, 1889 [1890].—Describes as new *Cabrilla* [n. g.] *occidentalis*, and gives notes on *Chioræa leontina*.

*Von Martens, E.—Eine ausgestorbene Landschnecke von den Bermuda Inseln (*Helex nelsoni* Bland). *Stz. Geo. Natur. Fr.*, Berlin, 1889, p. 201.

*Cockerell, T. D. A.—Note on *Patula cooperi*. *Journ. Conch.*, VI., p. 17, 1889.

*Smith, Edgar A.—On the Mollusca collected by Mr. G. A. Ramage in the Lesser Antilles. *Ann. and Mag. Nat. Hist.*, III., p. 400, 1889.

*Cockerell, T. D. A.—Preliminary remarks upon the molluscan fauna of Colorado. *Journ. Conch.*, VI., p. 65, 1889.

——Some notes on Dr. A. R. Wallace's Darwinism. *Nature*, XLI., p. 393, 1890.

Dall, W. H.—A preliminary catalogue of the shell-bearing marine mollusks and brachiopods of the southeastern coast of the United States, with illustrations of many of the species. Bull. U. S. Nat. Mus., No. 37, 1889, pp. 221, pls. 74.—Enumerates 487

Lamellibranchs, 44 Scaphopods, 33 Pteropods, 1127 Gasteropods, and 2 Cephalopods; implying a total molluscan fauna of "at least eighteen hundred forms."

*Stearns, R. E. C.—Notes and comments on the distribution of *Planorbis bicarinatus*. *West American Scientist*, VI., p. 110, 1889.

Sterki, V. A.—A Study of the American species of Vertigo contained in the U. S. Nat. Mus., with a description of a new sub-genus of Vertigo. Proc. Nat. Mus., XI., p. 369, 1888 [1889].—New sub-genus Angustula.

NEWLY-DISCOVERED GLACIAL PHENOMENA IN THE BEAVER VALLEY.

BY P. MAX FOSHAY AND R. R. HICE.

At the mouth of Connoquenessing Creek the valley of the Big Beaver is typically developed. The hills on either side, rising to an elevation of 1200′ + A.T., slope rather gently down to the old base level plain, here at an elevation of 180′+ above the present river level, or 910′ + A.T. This plain marks the level of a system of preglacial drainage at this point, which, as has been heretofore suggested, was probably to the north. The plain is covered with a fine, close, and very tough whitish or yellowish clay, shading away at some points into a mixture of sand and gravel, the pebbles for the most part being well-rounded quartz, in size from one and one-half inches in diameter downward.

Near the middle of this old river valley is a gorge, 200 to 300 yards in width, cut almost perpendicularly into the heavy sandstones, the Homewood and lower members of the Conglomerate series, and reaching to a depth of 125′ + below the present level of the Beaver, having a total depth of 300′ +.

Two or three miles to the north occur great deposits of morainic material,[1] which were supposed to mark the southern limit of glacial action in the Beaver valley.

[1] H. C. Lewis and G. F. Wright, Second Geological Survey of Penna., Vol. Z, p. 194.

At the mouth of the Connoquenessing, and lying upon the old base level plain, are several deposits of stratified gravel, having irregular hummocks, forming in some places small but well-defined kettle-holes; in short, partaking of the characteristics of kames, and apparently overlying the whitish or yellowish clay above mentioned. Lying south of the terminal moraine as heretofore mapped, some doubt was at first raised as to their true character, a doubt since removed by a more careful examination of the largest of them, and the discovery of grooves and striæ on the cliffs of the rock-gorge.[2]

The largest of these deposits is of an "L" shape, with the longer arm lying in the direction of the river valley, and almost a mile in length. It reaches thirty to forty feet above the base level plain, and the top is formed into irregular hummocks, covered with a thin, gravelly soil. The only sections seen showed clear but irregular stratification, and we did not feel sure we saw the junction of the kame and underlying clay at any point. We were informed, however, that, after passing through the gravel, as much as eleven feet of hard, tenacious clay had been penetrated without reaching the rock.

This, the largest deposit, lies on the western side of the river, a little above the mouth of the Connoquenessing. There are other deposits, of essentially the same structure, a mile further south (just north of Clinton Run), and on the eastern side of the river one is seen on the old base level plain of the Connoquenessing, one-fourth mile from the Beaver.

On a close examination of the base of the largest kame, in the search for its junction with the underlying clay, a new feature of glacial action in the Beaver valley was discovered, in a number of grooves and striæ. On its eastern side the gravel reaches at one point to the bluff of the rock-gorge, and the massive rock having been quarried for building purposes, the surface of the sandstone was seen. The top of the gorge is here in the Homewood sandstone, at this point a massive, rather coarse-grained, quartz rock, slightly colored with iron. The

[2] The nearest striæ reported are one-half mile northwest of New Castle. Second Geol. Survey of Penna., Vol. Z, p. 196.

quarry has been but little worked, and the grooves could not be followed for any distance on account of the overlying gravel. The direction of the face of the sandstone is S. S. W., and the grooves and striæ cut the face at an angle of about 60°, their direction being about S. E. by S., practically at right angles to the glacial border. The direction of the old valley is here nearly north and south, hence the grooves and striæ cut the valley at an angle of nearly 45°, and must have ended abruptly on the cliffs of the rock-gorge.

The largest groove is about five feet in width and eighteen inches in depth, the entire surface being striated in the direction of the groove. The smaller grooves lie in the same direction, and the entire surface seen (some forty feet) is uniformly scratched. No indications of cross striation were seen on the rock in place, but on a loose fragment (4′ × 3′) left in quarrying some indications of cross striæ were visible.

Some ten or twelve rods to the south, in another quarry, striæ were also seen, running in the same direction; here they were visible for some fifteen feet. The sandstone at this point is a Conglomerate, the pebbles reaching three-eighths of an inch in diameter. Here the surface is filled with pot-holes, from one to five feet in diameter, and from one to two feet in depth. None were seen entire, all the exposed ones being more or less shattered in quarrying. The pot-holes are not in anywise striated, nor does the striating agent appear to have affected the edges of the holes, which are as sharp as those now forming in similar sandstones. The general appearance of the pot-holes indicates that they were made by a north-flowing stream, and we believe they are older than the striæ, though the evidence is as yet incomplete.

Beaver, Pa., July 29, 1890.

THE DISTRIBUTION OF PLANTS.

BY V. M. SPALDING.

AN unusual degree of interest has recently been manifested, both in the general subject of the geographical distribution of plants, and in the special study of areas occupied by natural groups, with reference to questions of relationship. In view of this interest, indicated in part by various important papers and monographs that have lately appeared, it may be that an outline of the historical development of the subject, and the present condition of our knowledge in regard to it, may serve a timely purpose.

The history of the philosophical study of geographical distribution properly begins, with the opening of the present century, with the classical essay of Alexander von Humboldt on the "Geography of Plants."[1] Fifty years before that time Linnæus[2] had discussed the habitats of plants, with reference to the physical conditions by which they appeared to be determined, and somewhat later had considered the dissemination of seeds by winds and other agencies, and the influence of climate and latitude; but Humboldt was the first to approach this study with the distinctively scientific spirit that subordinates facts to principles, and endeavors to give to all observed phenomena a rational explanation.

Humboldt's habits of study led him to think of the vegetation of the earth from the standpoint of the physical geographer rather than that of the biologist. In the "Ansichten der Natur," published in its final form many years later, the prominence still given to physical conditions, and the fixed habit of deriving conclusions from numerical data, furnish a striking comment

[1] Essai sur la Géographie des Plantes, 1805.

[2] For a brief and discriminating reference to the writings of Linnæus upon the subject, and the still earlier observations of Tournefort, see the address of Sir J. D. Hooker before the Geographical Section of the British Association at the York meeting, 1881, where other important references may also be found.

upon the hopefulness of attaining correct biological conceptions through strictly mathematical processes. He laid down the principle that "the predominance of certain families of plants determines the character of a landscape, and whether the aspect of the country is desolate or luxuriant, or smiling and majestic;" and further, that "the predominance of a particular species, as to the number of individuals,—the mass,—or, on the other hand, the lack of certain species, may give to a region a peculiar physiognomy." Connecting his thought, in the usual way, with man and his welfare, he says: "Grasses forming extended savannahs, or the abundance of fruit-yielding palms, or social coniferous trees, have respectively exerted a powerful influence on the material condition, manners, and character of nations, and on the more or less rapid development of their prosperity."

From this point of view, then, the first thing to be undertaken in the study of the geography of plants was to bring out the conspicuous characteristics of the flora of a given region by determining the number of species of a particular family, as compared with the whole number of species constituting the flora of the region in question. As a single specimen of the laborious comparisons carried out by him may be cited his tabulated statements of the estimated preponderance of various families of plants in the north temperate zone.[3]

It is unnecessary to say that he did not possess, at that time, sufficient data for making such estimates more than approximate. Nor if they had been exact would they have brought out the real principles involved. Humboldt himself seems to have felt this, and to have groped almost painfully after the solution of the problem. "The forms of organic beings," he says, "are reciprocally dependent on one another. Such is the unity of nature, that these forms limit each other in obedience to laws which are probably connected with long periods of time." He anticipated,

[3] The number of species of several conspicuous families were compared with the whole number of species of that zone. Thus:

Glumaceæ, $\frac{1}{8}$.	Umbelliferæ, $\frac{1}{40}$.
Compositæ, $\frac{1}{8}$.	Amentaceæ, $\frac{1}{45}$.
Leguminosæ, $\frac{1}{18}$.	Cruciferæ, $\frac{1}{19}$.
Labiatæ, $\frac{1}{24}$.	

in some measure, the results of later investigations; but even his extraordinary genius, that seemed to compass the whole earth in its giant grasp, was forced at last, baffled and eluded, to yield the question and leave the field.

Humboldt's real service, then, was not so much in developing the laws of distribution as in boldly stating the problem and showing more clearly than it had ever been shown before how much there was to be accounted for. It needs but a slight acquaintance with his writings to feel convinced that the whole subject of distribution had scarcely been worked beneath the surface; the lines had been sighted and the stakes driven, but deeper explorations were left for future workers.

The well-known treatise of Alphonse De Candolle, "The Géographie Botanique Raisonnée,"[4] appeared just half a century after the publication of Humboldt's essay. It is hardly too much to say that, compared with all that had preceded it, this great work showed such an increase of knowledge, with a breadth of view and capacity for generalization, as rendered it a permanent record of the sum total that had been accomplished up to the middle of the present century in this study.

An examination of De Candolle's treatise shows that there were, at that time, clear ideas regarding the relations of plants to physical conditions; that the shape of the area occupied by a species —approximately circular or elliptical—had been noticed; and disjoined species—those occupying widely separate areas—had received a certain amount of attention; that the greater part of existing species were then, as now, held to be of high geological antiquity, although it was also held that they originated by successive creations; and finally that the relations of species to genera, families, and higher groups were beginning to be studied in the light of facts of distribution.

De Candolle had fairly done what, at this time, lay within the power of man to do. He had gathered an overwhelming array of facts, had marshalled them with orderly precision, had tried them—not wholly satisfactorily, it is true—with reference to their theoretical bearing, and had given them to the world ready to use.

[4] Paris, 1855.

But there was still needed some great fundamental conception to bind these facts together into a consistent whole; and this conception, brought out three years later in the famous papers of Wallace and Darwin before the Linnæan Society, was embodied and applied, more and more completely, in the various monographs and essays of the three botanists: Asa Gray in the United States, and J. D. Hooker and George Bentham in England.

The history of the subject now becomes so largely identical with the contributions of these three men[5] that we can do no better than to follow each one of them step by step in his work, and see, as far as we are able, the facts as they saw and interpreted them.

The botanical contributions of Asa Gray, taken as a whole for fifty years, bore more or less directly upon the subject of geographical distribution. One of his earliest reviews is a notice of Siebold's Flora Japanica,[6] in the course of which the remark is made that "the flora of Japan presents such striking analogies to that of the temperate part of North America as to render this work of more than ordinary interest to American botanists;" and again, in 1846, he takes the occasion offered in another review to say: "It is interesting to remark how many of our characteristic genera are represented in Japan, not to speak of striking analogous forms."

This remarkable fact, having once been clearly formulated, was never lost sight of, and although it seemed incapable of explanation upon any theory then held regarding the nature of species, Dr. Gray lived long enough to find the clue to its meaning, and to show the far-reaching and fundamental nature of the principle involved.

[5] All mention of such works as those of Schoua and Griesbach, however valuable for their statement of facts, has purposely been omitted. The service rendered by those who collect data exhaustively and accurately is by no means called in question, but it does not fall within the purpose of the present sketch to consider any treatises, however extended, that cannot be shown to have definitely contributed to a better comprehension of the principles in this study. For an entirely different reason, it has been thought best to omit any discussion of the well-known papers of Forbes and Darwin, although the former was called by Hooker "the reformer," and the latter "the greatest lawgiver," of the science of geographical distribution.

[6] *Am. Jour. Sci.*, Oct., 1840.

In 1856 and '57 Dr. Gray published in the *American Journal of Science* a continued article on the Statistics of the Flora of the Northern United States,[7] in which facts in line with those already indicated were brought out at much greater length, statistical comparisons being made between the numbers of orders, genera, and species indigenous to the Northern United States and those of Europe and Eastern Asia respectively; the close relationship of the floras of the two great continents again being brought out in a still more striking manner. His remarks on the theoretical bearing of these facts are of special interest from having appeared some little time before the "Origin of Species." Dr. Gray says: "As the discussion of this most difficult problem proceeds, the two antagonistic positions only appear to be tenable. . . . . The first theory is based upon the natural idea of species as consisting of kindred individuals descended from a common stock which, whether demonstrable or not as a fact, gives us a clear and distinct conception of species, and the only one we possess, The second theory, being incompatible with this conception, leaves species no objective basis in nature and seems to make even the ground of their limitation a matter of individual opinion."

Here was the essential conception of the real nature of species, —a conception that became more fixed as his studies continued, and was expressed more at length in a memoir presented to the American Academy in 1858–'59,[8] in which Dr. Gray says: "The natural supposition is that individuals of the same kind are descendants from a common stock, or have spread from a common center; and the progress of investigation, instead of eliminating this preconception from the minds of botanists, has rather confirmed it."

Without attempting to condense or reproduce further the substance of these earlier papers, it is enough to say that in them had already been clearly formulated two essential principles, viz., the genetic relationship of plants of the same and "representative" species, and repeated migrations under changed climatic

[7] *Am. Jour. Sci.*, 2d Ser., Vol. XXII. (1856), and Vol. XXIII. (1857).

[8] Memoirs Am. Acad., New Ser., Vol. VI.

conditions. His later papers[9] extend and confirm the observations recorded in these; and the fact that the accumulations and research of nearly thirty years afterwards did not change his views in any essential particular is of importance. The history of the big trees of California, of the forests of the Northern Continents, and the peculiarities and resemblance of the North American flora as compared with those of Europe and Asia, still were shown to point unmistakably to migrations from a former common, though extended, area, with subsequent modifications in accordance with the theory of descent.

Dr. Hooker covered a different ground in his study of geographical distribution. Taking up successively the Antarctic flora, and those of New Zealand, Tasmania, and the Oceanic Islands, it was only at a later period in his investigations of the floras of Southern Asia and of the Arctic regions that he overlapped in any way the ground already occupied by Dr. Gray.

His position in regard to theories then prominent was distinctly indicated in the "Introductory Essay to the Flora of Tasmania."[10] Referring to the flora of New Zealand,[11] in which he had given (though without distinctly endorsing) the prevalent view, that species are created as such, he says: "In the present essay I shall advance the opposite hypothesis, that species are derivative and unstable."

Of the observed facts recorded in this series of monographs only a few of the most important can be mentioned.

It was shown in the Flora Antarctica that a certain relationship exists between floras of the Antarctic Islands and that of the ex-

[9] Three papers of Professor Gray contain his latest contributions to this subject, and represent his mature views and final judgment regarding the distribution of plants in the Northern Hemisphere. These are:

1. Sequoia and its History: The Relations of North American to Northeast Asian and to Tertiary Vegetation. A presidential address to the American Association at Dubuque, August, 1872.

2. Forest Geography and Archeology. A lecture delivered before the Harvard University Natural History Society, April, 1878.

3. Characteristics of the North American Flora. An address to the botanists of the British Association at Montreal, August, 1884.

[10] *Am. Jour. Sci.*, 1860, Vol. XXIX.

[11] Reviewed in *Am. Jour. Sci.*, 1854, Vol. XVII.

treme southern portion of the American continent, and subsequent study brought out a far greater extension of this relationship.

A further interesting observation was that the plants of the Antarctic Islands that are also natives of Tasmania, New Zealand, and South America, are almost invariably found only on the lofty mountains of those countries.

In view of these and other results, Dr. Hooker was strongly impressed with the view that existing agencies are not sufficient to account for the observed facts, and concludes that these floras "exhibit a botanical relationship as strong as that which prevails throughout the land within the Arctic and Northern Temperate zones, and which is not to be accounted for by any theory of transport or variation, but which is agreeable to the hypothesis of all being members of a once more extensive flora, which has been broken up by geological and climatic causes."

In the "Outlines of the Distribution of Arctic Plants," published in 1861, an attempt was made to trace the distribution of every phænogamous species known to occur spontaneously within the Arctic circle. The distinctively Scandinavian character of the Arctic flora, the remarkable deficiency of Greenland in characteristically American species, and the fact that no close relation was discovered between the isothermal lines and the amount of vegetation, so that the observed facts remained to be accounted for in some other way than by reference to present climatic conditions, were some of the most important results of this study. The explanation offered involved the two principles already established by Dr. Gray, viz., the community of origin of closely related species, and forced migrations under the influence of climatic changes.

The results of Dr. Hooker's study of insular floras were embodied in a paper presented to the British Association at its Nottingham meeting in 1866.[12] It contained the most extended account that has yet been given of island life from the strictly botanical point of view. The author emphasizes the fact that the flora of no oceanic island is independent and *sui generis*, but is always very manifestly allied to some continental flora; but that they all

[12] Translated in the *Ann. des Sci. Nat.*, Sér. V., Tom. 6.

have numerous and very remarkable species peculiar to them, and which distinguish them from the continental islands. He discusses at length the possibility of transoceanic communication, and although still impressed with the difficulty of accounting for the distribution of plants on oceanic islands by reference to agencies now in operation, he is far less inclined to deny that these may be sufficient than in his discussion of the floras of New Zealand and Tasmania. In fact, he seems ready to admit the full force of the argument, as recently stated by Wallace, for their distribution by natural agencies now acting, although there were still certain difficulties that did not seem to him to readily yield themselves to such an explanation.

Hooker's extended and long-continued study of the distribution of plants in every part of the Eastern hemisphere had led him to essentially the same conclusions as those reached by Dr. Gray. Both had come perforce to think of species as unstable, and both, while recognizing to the full extent the action of existing agencies of dispersal, had felt the necessity of assuming the action of climatic changes antedating the present geological epoch, the results of these changes being in a good degree definite and ascertainable in the Northern hemisphere, less definite and more perplexing in the Southern.

The most voluminous writer, and the one who has perhaps done the most, taken all in all, to advance our knowledge of the distribution of plants, was George Bentham, who for fifty-seven years, ending with his death in 1883, contrived to produce, one after another, floras, monographs, and other botanical papers, until even a review of them become a herculean task.

He approached the subject differently from either Gray or Hooker. Finally recognizing, equally with them, the importance of the theory of descent as an essential factor, he undertook to apply this by a laborious and exhaustive comparison of botanical characters and actual geographical location of species, genera, and sub-orders. "If," he says, "the two theories be admitted, that allied species and genera have a common origin, and that the descendants of a common stock placed in different regions having no inter-communication will vary in these different regions

with different combinations of characters, it will be seen how much geographical distribution may be made to check the value given to generic or other groups founded upon technical distinctions." In other words, he inaugurated the actual use of facts of geographical distribution as an aid to classification.[13]

The method pursued by Gray and Hooker in determining the species that occupy a given region, and comparing this region botanically with others, brings the geographical side of the question into prominence; and in the hands of botanists conversant with the principles of physical geography it has served to furnish important evidence bearing upon questions that are properly of a geological nature. Bentham's method, on the other hand, consisting in the exhaustive study of various families of plants, with the distribution of each of their species, as far as this is known, the world over, suggests greater possibilities than the former, inasmuch as it offers at least the hope of one being able some time to follow, step by step, the descendants of a common ancestor as they have spread themselves over the face of the earth. Such monographs as those of Bentham's on the Campanulaceæ[14] and Compositæ[15] are excellent specimens of what has already been accomplished in this direction, and if they are somewhat disappointing in coupling few conclusions with enormous labor, they point out none the less the way in which those who care to lay solid foundations for future studies of this kind will probably choose to work.

Thus far it has been attempted rather to indicate the successive steps that have been taken in this line of investigation since the time it became a subject of scientific inquiry, rather than to discuss results and theories. If, now, a brief summary of the present status as a whole is made, it appears, in the first place, that the observed facts relating to the distribution of plants correspond in every essential respect with what has been observed of the

[13] The results of Bentham's studies up to 1869 are epitomized in the presidential address of that year to the Linnæan Society (translated in the *Ann. des Sci. Nat.*, Sér. V., Tom. XI.), and are summarized by Prof. W. T. Dyer in the article "Distribution;" in the Encyclopedia Britannica.

[14] *Jour. Linn. Soc.*, Vol. XIII.

[15] Ibid., Vol. XV.

geographical distribution of animals. Making allowance for the greater age of plant life and the facility with which seeds are carried over barriers not easily crossed by animals, it is plain that the same laws have governed in the one case as in the other.

In the second place, although the theory of dispersal of each species from a single centre, occupied by its own ancestral form, has been found to harmonize better with the facts thus far observed than any other, the application of this principle, simple and intelligible in itself, is beset with practical difficulties, owing to the complicated relations of the various agencies involved.

It seems perfectly plain, for example, that changes of climatic conditions have had much to do with the present distribution of plants in both hemispheres, but just how much it is hard to tell; and, in the same way, the extent to which ordinary means of dispersal, such as wind, water, etc., have operated can hardly be determined with precision.

To illustrate: when we find in Eastern Asia our own goldthread, blue cohosh, twin-leaf and mandrake; poison ivy and prickley ash, Mayflower, snowberry, partridge-berry, and a host of other either identical or equivalent species, and find all these absent from Europe, we feel no hesitation in taking these facts in connection with the paleontological evidence in assuming that the changes of climate during the glacial epoch have been largely, we might fairly say chiefly, the physical factors involved; but when we find, to follow Hooker's enumeration, fifty and seventy-five New Zealand plants indigenous to Northern Europe, thirty-eight common to Australia, Northern Europe, and Asia, about fifty of those of Terra-del-Fuego in North America and Europe, and close relatives of other European species on the island of Fernando Po and the mountains of Abyssinia, it is by no means easy to account for it all.

Much is still required, from different sources, in order to the future advantageous study of the whole question. It is hardly necessary to say that notwithstanding the very extensive collections of plants that already exist in numerous herbaria, the first condition of the comprehensive study of any one order with reference to its distribution is the gathering of still more of its

species, particularly from regions still imperfectly known botanically, into the great herbaria where proper facilities for study and clasification are provided.

There is great need of more exact observations of actual cases of transportation of seeds to great distances. We are not yet in a position to say, with definiteness, how much can be explained in this way. Whoever records a single absolutely reliable observation of this kind will render a good service.

Climatic changes remain, and probably must still remain, the the least definite of all the factors thus far considered. From whatever source it may come, a clearer conception of the physical conditions formerly prevailing in the Southern hemisphere seems indispensable. This is, perhaps, not hopeless, but it is, to all appearances, not likely to be immediately realized.

Paleontological evidence has been slowly accumulated, enough to show how much need there is of more. Species now perfectly isolated, living in tropical America on the one hand, and in Southern Asia on the other, have had their relations cleared up by finding their ancestral forms scattered through the intervening regions; and the prosecution of this part of the study is as hopeful as it is difficult. But the successors of Heer and Lesquereux are not likely to be numerous, nor to turn out results very rapidly.

One more side of approach remains, seemingly most hopeful, perhaps really most hopeless of all; offering almost unlimited possibilities, but involving endless labor and endless complications. This is the study of single groups from a more strictly biological standpoint. Nothing but the merest beginning has yet been made. The method is illustrated in a short paper recently prepared by Prof. Huxley; more, apparently, as a piece of tentative preliminary work suggestive of what may be done than as a formal contribution.[16]

Spending a few weeks, in the summer of '86, in the mountain region near the valley of the Rhone, he began to study some of Alpine flowers, and among them the gentians. He at once experienced trouble in "analyzing" the species, which, as in so many other cases, obstinately refused to conform to the book

[16] *Jour. Linn. Soc.*, Vol. XXIV., 1888.

descriptions, and finally set out to see for himself what such an amount of variation meant.

Confining himself to the structure of the flowers, as he afterward studied the order at the Kew Gardens, he found some seven or eight modifications of its structure, arranged in two series, and presenting a complete gradation of forms, from the completely open, stellate condition, through the bell-shaped to the extreme tubular forms with which we are best acquainted in our American flora. A comparison of these various forms indicates their derivation by successive slight modifications from an original, simple flower that Professor Huxley calls the "ur-gentian," and Müller, in the "Alpenblumen," [17] does not hesitate to employ to its full extent the Darwinian theory to explain the evolution of the more highly developed and differently colored forms to the agency of insects, particularly bees and butterflies.

If this is admitted, it becomes quite as necessary to know the whereabouts and habits of bees and butterflies as to study the gentians themselves, and the interesting hint is thrown out that those gentians that have remarkably long, tubular corollas are found in such regions as Madagascar and Guiana, with their large Lepidoptera provided with a long suctorial apparatus.

Evidently a somewhat complicated set of relations has been introduced; and after still other suggestions looking in the same direction, Prof. Huxley adds to our feeling that the subject is growing in magnitude by saying: "I think there is no greater mistake than to suppose that distribution, or indeed any other large biological question, can be studied to good purpose by those who lack either the opportunity or inclination to go through what they are pleased to term the drudgery of exhaustive anatomical, embryological, and physiological preparation."

Finally he raises the significant question: "Is anybody in a position to deny that, in the absence of all other phænogamous vegetation, the gentians might have occupied every region and station on the earth's surface in which flowering plants can exist? Is there any ground for seeking the causes of this distribution elsewhere than in the competition with other plants which they

[17] Quoted by Huxley, l.c.

have undergone and are undergoing, and in the course of which it has often happened that the success of a given form in adapting itself to certain conditions has involved a corresponding diminution of the faculty of adapting itself to others? . . . From the point of view of the evolution doctrine," he adds, "it is obvious that taxonomy and distribution have to be subjected to a process of revision which will hardly fail to revolutionize both."

Manifestly the end has not yet been reached. A panorama of more than ordinary interest has been going on, larger than it is easy to imagine, and we are barely able to get a partial view of its latest phases, or, at rare intervals, to read fragments of its history. And yet it is perfectly certain that the effort to see and comprehend more of it will never be abandoned. New glimpses are obtained from time to time as the curtain is lifted a little way, and once in a while a portion of the old record comes to light and gives new hope and a new impulse.

University of Michigan.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

THE late meeting of the American Association for the Advancement of Science, held at Indianapolis, was a pleasant and instructive occasion. The local accommodations were of the most ample character. The sections met under the roof of the State Capitol, and the conveniences of the building were thrown open to the Association. The scientists of Indiana lent their aid to render the occasion worthy of the high place which the State holds in the Union as a centre of scientific work. The city of Indianapolis contains a large intelligent and progressive element, which has kept pace with the remarkable increase in population which the city has experienced during the last decade. This intelligence was especially reflected in the press reports of the proceedings, which were among the best that the Association has received.

Many papers of a high order of merit were read, both before the regular sessions and before the botanical, entomological, and

ornithological clubs, which met at intervals during the meeting. The one excursion which the local committee arranged to come off during the session, that to the regions of the gas wells, north-east of the capital city, was well attended. To the many members who had not seen the extraordinary phenomena which these localities display, the excursion was of great interest. Perhaps the most effective scene was that witnessed at Anderson after nightfall, when the gas-jet was turned into the water of the White River. The extraordinary pressure threw the latter into a boiling caldron of flame and fluid.

—Among the various official acts of the Association there is only one to which we take exception: that is the abolition of the Committee on the International Congress of Geologists. This committee has been a useful one. It has furnished to the Congress the only complete synopsis of the geological formations of North America in existence. This work is already somewhat behind the times, so rapid is the progress of discovery, but the committee was expecting to supply such deficiency from time to time to the succeeding meetings of the Congress. But it has done more than this. It has suppressed at their inception various crude and unscientific products of the official geology of the country. It refused to adopt Director Powell's scheme for revising the colors of our geological maps, as compared with those hitherto in use throughout the world. It declined to insert in its reports the great discovery of the "Agnotozoic" (!) era, which was to occupy a position between the "Azoic" and the Paleozoic. It declined to adopt some innnovations in nomenclature desired by the same authority, regardless of the law of priority. For these and similar reasons the committee incurred the displeasure of the geological autocrat at Washington, and he determined on the control or abolition of the committee. Failing in the former, he determined on the latter, and he has succeeded. This was partly due to the weakness of some of the members of the committee themselves, who wearied, prematurely as it appears to us, of the perpetual antagonism to which they were subjected. And now we suppose that the Geology of America will be "officially" reconstructed and presented brand new to the Congress of 1892, in Washington, if any is ever held.

RECENT BOOKS AND PAMPHLETS.

ABBOT, F. E.—Scientific Theology the Ground of all Liberal Religion. Ext. *Unitarian Review*, Dec., 1889.

Annales de la Société Belge de Microscopie, Tome XIII.

Annuaire de l'Académie Royale des Sciences, des Lettres, et des Beaux-Arts de Belgiaue, 1890.

AYRES, H.—The Morphology of the Carotids. Ext. Bull. Harvard Mus. Comp. Zool., Vol. XVII.

BEECHER, C. E., and J. M. CLARKE.—The Development of Some Silurian Brachipoda. Memoirs of the New York State Museum, Vol. I., 1889. From the author.

BRIDGE, T. W.—The Air-Bladder and Weberian Ossicles in the Siluridæ. Ext. Proc. Roy. Soc., Vol. XLVI. From the author.

BRITTON, N. L.—The Genus Eleocharis in North America. Ext. *Journ. New York Microscopical Soc.*, Oct., 1889. From the author.

Bulletin No. 8, Exp. Station, Kansas State Agricultural College.

Bulletin de la Société Zoologique de France, 1889.

Bulletin of the Agricultural Exp. Station, Cornell University.

Bulletin Nos. 48–53, inclusive, U. S. Geol. Sur. From the Dept. Interior.

CALDERON, S.—La Région Épigénique de l'Andalousie et l'Origine de ses Ophites. Ext. Bull. Soc. Geol. de France, Troisième série, Tome Dix-septième. From the author.

CARTAILHAC, E.—La France Préhistorique. From the author.

CLARKE, J. M.—The Hercynian Question. Ext. Forty-second Annual Rep. N. Y. State Mus. From the author.

CONN, H. W.—Coleopterous Larvæ and their Relations to Adults. Ext. Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889.

Constitution of the Geological Society of America.

COPE, E. D.—Report on the Batrachians and Reptiles Collected by the U. S. Fish Commission *Albatross*, in 1887–'88. Ext. Proc. U. S. Nat. Mus., Vol. XII.

DERCUM, F. X.—Facts and Deductions Bearing on the Action of the Nervous System. Ext. *Journal Nervous and Mental Diseases*, Vol. XIII., 1886. From the author.

DWIGHT, W. B.—Recent Explorations in the Wappinger Valley Limestones and other Formations of Dutchess Co., N. Y. Ext. *Am. Journ. Sci.*, Vol. XXXVIII., 1889.

ELDRIDGE, G. H.—Some Suggestions Upon the Method of Grouping the Formations of the Middle Cretaceous, and the Employment of an Additional Term in its Nomenclature. Ext. *Am. Journ. Sci.*, Vol. XXXVIII., 1889. From the author.

ELLIS, H.—Women and Marriage. From the author.

Extrait du Compte-Rendu des Séances du Congrès International de Zoologie, Paris, 1889.

FRITSCH, A.—Fauna der Gaskohle und der Kalksteine der Permformation Böhmens. Selachii, Band II., Heft 4. From the author.

GATSCHET, A. S.—Linguistic and Ethnographic Notes. Ext. *Am. Antiq.*, 1889.

Geol. Sur. Kentucky, 1888.

Geol. Sur. Penna., Vol. I., 1889.

HERNANDEZ, F.—Nova Plantarum, Animalium, et Mineralium Mexicanorum Historia. From the author.

HYATT, A.—Genesis of the Arietidæ. Smithsonian Contributions to Knowledge.

IRVING, A.—Metamorphism of Rocks. From Longmans, Green & Co., publishers.

KARPINSKY, A.—Über die Ammoneen der Artinsk-Stufe und einige mit denselben verwandte carbonische Formen. Memoires de l'Acad. Imp. des Sciences de St. Petersbourg, Tome XXXVII., No. 2. From the author.

LAHUSEN, J.—Ueber die Russischen Angellen. Memoires du Comité Geologique, Vol. VIII., No. 1.

LAMBORN, R.—The Knees of the Bald Cypress. Ext. *Garden and Forest*, Jan., 1888. From the author.

LAMPERT, K.—Die Während der Expedition S. M. S. Gazelle, 1874–1876, von Prof. Dr. Th. Studer gesammelten Holothurien. Separatabdruck aus den *Zoologischen Jahrbüchern*. From the author.

LANGLEY, S. P.—The Solar and Lunar Spectrum. Second Memoir Nat. Acad. Sci.—The Temperature of the Moon. Ninth Memoir Nat. Acad. Sci.

LESLEY, J. P.—A Dictionary of the Fossils of Penna. and Neighboring States Named in the Reports and Catalogues of the Survey. Report P 4, 1889, Geol. Sur. Penna.

LOOMIS, E.—Contributions to Meteorology. Seventh Memoir Nat. Acad. Sci.

MERRIAM, H. C.—Revision of the North American Pocket Mice.—Descriptions of Fourteen New Species and One New Genus of North American Mammals.

MINOT, C. S.—Uterus and Embryo: I. Rabbit; II. Man. Ext. *Journ. Morph.*, Vol. II., 1889.

MONTGOMERY, E.—Mental Activity. Ext. *Mind*, Vol. XIV. From the author.

MOOREHEAD, W. K.—Fort Ancient, Ohio. From Robt. Clarke & Co.

NEWTON, E. T.—Description of a New Species of Clupea from the Isle of Wight. Ext. *Quart. Jour. Geol. Soc.*, Feb., 1889. From the author.

PACKARD, A. S.—On a Fossil Macruran Crustacean from Peru. Ext. Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889. From the author.

PARKER, W. K.—On the "Manus" of Phœnicopterus. Ext. *Ibis*, April, 1889.

PATTEN, W.—Studies on the Eyes of the Arthropods. Ext. *Journ. Morph.*, Vol. II., 1888. From the author.

PEPPER, W.—The University in Modern Life. From the author.

PORTER, A.—Famine Diseases. From H. K. Lewis, publisher.

Report of the Geol. and Nat. Hist. Survey of Minnesota, 1888. From the Survey.

Revue Biologique du Nord de la France, Nov., 1889.

Report U. S. Fish Commission, 1886.

Report Penna. Geol. Sur., 1887.

RIVERS, J. J.—Description of a New Turtle from the Sacramento River. Ext. Proc. Cal. Acad. Sci., Vol. II.

ROBERTS, O. M.—History and Burden of Taxation. Bull. Texas University, 1889. From R. T. Hill.

ROHANT, C. A.—Du Transformisme et de la Génération Spontanée. From the author.

SCUDDER, S. H.—The Work of a Decade upon Fossil Insects. Ext. from *Psyche*, 1890.

SHUFELDT, R. W.—Contributions to the Comparative Osteology of the Families of North American Passeres.—Notes on the Anatomy of *Speotyto cunicularia hypogæa*. Exts. *Jour. Morph.*, Vol. III., 1880. From the author.

STEARNS, R. E. C.—Ethno-Conchology: A Study of Primitive Money. Ext. Report Nat. Mus., 1886–'87.

——Description of a New Species of Alcyonoid Polyp. Ext. San Francisco *Mining and Scientific Press*, 1873.

STONE, G. H.—On the Scratched and Facetted Stones of the Salt Range, India. Ext. *Geol. Mag.*, Vol. VI., 1889. From the author.

——The Principles of Mechanics as Applied to the Solar System.

THEOBALD, W.—Index of the Genera and Species of Mollusca in the Hand List of the Indian Museum, Calcutta. Parts I. and II., Gastropoda. From the Museum.

THOMPSON, D. G.—Life, Writings, and Philosophy of Herbert Spencer. *Modern Science Essayist*, Vol. I., 1889.

TOPINARD, P.—La Société, L'Ecole, Le Laboratoire et La Musée Broca. From the author.

Transactions of the Wagner Free Institute of Science, Phila., Vol. II.

Transactions Kansas Acad. Sci., Vol. X.

TRAQUAIR, R. H.—On the Structure and Classification of the Asterolepididæ. Ext. *Ann. and Mag. Nat. Hist.*, Dec. 1888.

TRAUBEL, H. L.—Camden's Compliments to Walt Whitman.

TRUE, F. W.—On the Occurrence of *Echinomys semispinosus* Tomes, in Nicaragua. Ext. Proc. U. S. Nat. Mus., 1888.

TSCHAN, A.—Recherches sur l'Extrémité anteriéure des Oiseaux et des Reptiles. From the author.

VAN BENEDEN, P. J.—Histoire Naturelle des Delphinides des Musées d'Europe.

VOSSION, L.—The Centennial Celebration of the U. S. From the author.

VASEY, G.—List of the Plants Collected in Alaska in 1888.

WALCOTT, C.—A Review of Dr. Ells's Second Report on the Geology of a Portion of Quebec, with Additional Notes on the "Quebec Group." Ext. *Am. Journ. Sci.*, Vol. XXXIX., 1890.

——Descriptive Notes on New Genera and Species from the Lower Cambrian or Olenellus Zone of North America.—Description of New Genera and Species of Fossils from the Middle Cambrian.—Descriptive Notes of New Genera and Species from the Lower Cambrian of North America.—Description of a New Genus and Species of Inarticulate Branchiopod from the Trenton Limestone. Exts. Proc. U. S. Nat. Mus., Vol. XII., 1888.

——The Value of the Term "Hudson River Group" in Geologic Nomenclature. Bull. Geol. Soc. Am., Vol. I. From the author.

WARD, L. F.—The Geographical Distribution of Fossil Plants. Ext. from the Eighth Annual Report of the Director, 1886–'87.

——Causes of Belief in Immortality. Ext. *Forum*, Vol. VIII., 1889.

——The Paleontologic History of the Genus Platanus. Ext. Proc. U. S. Nat. Mus., Vol. XI., 1888. From the author.

WEBER, M.—Zoologische Ergebnisse einer Reise in niederländisch Ost-Indien. From the author.

WESTLING, C.—Anatomische Untersuchungen über Echidna. Bihang Till K. Svenska Vet. Akad. Handlingar, Band XV., Afd. 4, 1889.

WHITEAVES, J. F.—Descriptions of Eight New Species of Fossils from the Cambro-Silurian Rocks of Manitoba. Trans. Roy. Soc. Canada, Vol. VII., 1889.

WILLIAMS, G. H., and A. C. GILL.—Contributions to the Mineralogy of Maryland. Ext. Johns Hopkins Univ. Cir. No. 75. From A. C. Gill.

WILL, L.—Bericht über Studien zur Entwickelungsgeschichte von *Platydactylus mauritanicus*. Sitzungsb. K. Preuss. Akad. Wissenschaften, 1889. From the author.

WILSON, E. B.—The Embryology of the Earthworm. Reprint *Journ. Morph.*, Vol. III., No. 3. From the author.

General Notes.

GEOGRAPHY AND TRAVELS.

Africa.—Captain Binger's Journey.—Further particulars of Captain Binger's journey in the districts between the Upper Niger and the Guinea Coast serve to show that this is one of the most important of recent journeys, both geographically and politically. It has proved the non-existence of the Kong mountains as a defined range; has shown that there are few affluents of the Niger from the south, and that the watershed between the coast rivers and the Niger lies much farther inland than was at first supposed; and it has led to the reception under French protectorate of all the country lying between the upper Niger and the French coast possessions, so that the English settlements of the Gambia and Sierra Leone, and the independent republic of Liberia, are now framed entirely in French territory. Starting from Bammako, Captain Binger passed Likaso, and then proceeded southeastward to Kong, which he reached on Feb. 20th, 1888. The town had not previously been visited by a European. On his passage he crossed several streams, one of which proved to be a tributary of the Laku, while two others were the head-waters of the Akba, or Comoe,—all of them three to four degrees further to the north than had been supposed. The watershed was marked simply by rising ground. Kong or Pong is a considerable trade-centre; cotton-weaving, indigo-dying, and horse-trading are carried on here, and the population seems to be from twelve to fifteen thousand. After three weeks' stay in Kong, our traveller set out northwards, crossed the upper course of the Comoe, and reached the head-waters of the most westerly tributary of the Volta, the Black Volta, near the sources of the Comoe. He hurried through the country of the Gurunsi, in anarchy through the incursions of the Haussas, and reached Wagadugu, whose capital, Mossi, is in the midst of a flat country, and is rich in corn and cattle. Compelled to quit this town, he abandoned his intention of making an excursion to Libtako and connecting his surveys with those of Barth. He then proceeded south to Salaga, which he reached October, 1888, after a detention through illness at Wale-wale of forty-five days. Following the right bank of the Volta, he entered Kintampo, a depot for kola-unts. On January 5th, 1889, he again reached Kong, where he met a

relief party, sent from the coast colonies by the governor, Treich Laplene. Both parties followed to the coast the river Akba, which is navigable as far as Attakru.

The greater part of the country included within the great northern bend of the Niger proves to be drained by the Comoe and the Volta, which latter is formed by three large tributaries, the White, Red, and Black Volta. Though there is no distinct range separating the basins of the Niger from those of the coast rivers, yet isolated granitic peaks rise above the general platform. In the west these culminate in Natinian Sikasso (2,560 ft.). Southward of this the platform sinks gradually, and here the Lahu and the Dahbu rise. Among isolated peaks more to the east is that of Kernono (4,757 ft.), which turns the course of the Comoe from east to south. From the Volta, which is surrounded with low hill-ranges, an extensive table-land stretches eastward, ascending from 3,250 feet to Nauri, in the southeast of Wagadugu, 5,905 feet high, and the highest point of the watershed, separated from the Gambaga range by the valley of the East or White Volta, which rises in Bussang. Sandstone and swamp-ore prevail in this region, which is poor, except in humid places. From March to June the heat was 104° in the shade, 140° in the sun. Captain Binger surveyed his route with the compass, and determined thirteen points astronomically. The natives belong to seven different groups: the Mondungo (Samory, Kong, Worodugu, Kurudugu, Gudja, etc.), colonised in all directions; the Sieneren or Sienufs, ranging from Tieba to Pegue, Follona, Djimmi, and Worodugu; the Gurungu, who prevail in Gurunsi and part of Bussang; the Moor Mossi; the Haussa, west of the White Volta; the Ashanti, as far as the Black Volta; and the Fulbe, whose chief abode is further north, but who have colonies to 11° N. Lat.

The Zambezi Delta.—In the March issue of the *Proc. Roy. Geog. Soc.*, 1890, D. J. Rankin gives an account of the Zambezi delta, and especially of the Chinde mouth thereof. The Quaqua cannot now be called strictly an outlet of the Zambezi, as the bulk of the waters which flow into it are derived from the drainage of the Shimwara and Achigunda hills and of the Borore heights. From Quillimane to the sea stretches a flat sodden swamp, bordered by mangroves. The tide rises to Mogorumbo, but from Lokololo to Quillimane goods have to be transported in lighters. The Kongoni mouth has 12 to 14 feet draught, but is not suitable, as its coasts are mere mangrove swamps, covered at high tides. The island of Inhainissengo is becoming rapidly

submerged. The Madredane channel, three miles long, is narrow, and so choked with reeds and aquatic vegetatation that a passage has to be hewn through it. The Mosella mouth is little known, but is said to have a bad bar at its junction with the main stream. The Melamba, Maria, East Luabo, and another mouth seem to be closed to navigation, as the sea always breaks over their bars. The Chinde mouth has, however, three fathoms on the bar at low water, and a channel 500 yards wide, and well defined. In an exceptionally dry season 20 to 23 feet were found on the bar at high water. There is a sandy point at the very mouth, and good anchorage inside it. Chinde village is at the junction with the main stream, ten miles up. The banks and channel of the main stream are continually changing direction under the influence of the immense body of water, full of vegetable matter, and depositing a light-colored ooze. The delta is thinly peopled, and the inhabitants are not indigenous, but have been slaves, and are of low social condition.

M. Dauvergne's Journeyings.—M. Dauvergne's explorations in the vicinity of the Hindu Kush, last year, led to several interesting geographical discoveries. He descended the valley of the Lung, and asserts that that river is a tributary of the Tashkurgan, and not of the Zerafshan. The valley is deep, difficult of access, warm, highly cultivated, and inhabited by Sunnite Mohammedans, who are Chinese subjects. The river flows west and southwest, with the Kundur mountains on the left bank, and the Kichik-tung on the right. Crossing the Kotti-Kandar pass (16,350 ft.), which has a glacier on the top, our traveller descended into the valley of the Tashkurgan, and then ascended that of Karachunkur. He afterwards camped with nomad Kirghises in various localities in an elevated rolling Pamir, resembling the Great Pamir.

Our traveller finds the sources of the Oxus or Amu-Daria near the pass of Wakijt-Kul, at a level of 15,500 feet, and states that they are fed by three enormous glaciers. To make certain, he followed the river for seventy miles.

It has been asserted that Karambar Sar, a small lake on the north side of the Hindu Kush, has two outlets, but one of the results of M. Dauvergne's explorations has been to dispel this idea. There are here two lakes in close proximity, the one the real Karambar Sar, about a mile and a half long, giving origin to the Karambar or Askaman River, while the other, situated a few hundred yards to the east, over a low rocky watershed, is about half a mile long, and gives outlet to the Ausa or Marghab. The smaller lake is named Gazkul.

Geographical News.—Africa.—J. R. Pigott has recently travelled up the Tana (Northeast Africa), ten days' journey beyond the farthest point reached by the Brothers Denhardt. Mount Kenia was in full sight during the latter part of the journey, and seems to be nearer the coast than has been supposed. The country is thinly peopled, for the inhabitants of the lower course of the river fear the Somalis, while those of the upper are in dread of the Wakamba. A map of the district traversed is given in the March number of the *Proc. Roy. Geog. Soc.*

A map of the journey of Mr. Selous in Mashona-land, in the basins of the Mazoe and the Mufu, tributaries of the Zambezi on the south, is given in a recent issue of the *Proc. Roy. Geog. Soc.*

Among recent journeys in South Africa deserves to be mentioned that of Mission Superintendent Knothe from Mphome on the Zoutpansberg to the land of the Bonjai or Bokharaka, southeast of the Barotse country. The Bonjai speak a language akin to the Sesuto, and are more skilled in handicrafts than the Bosuto. The brothers Posselt, in travelling north of the Limpopo to Simbabye, found certain ornaments, among which were three of gray gneiss or syenite, evidently in imitation of birds.

A small map in *Petermann's Mitteilungen*, 1890, Part I., shows the distribution of the Berber stems in Morocco. About one-half of the country is really Arab, stretching from the western limit of Algiers, south of the Ref Berbers, to the north coast by Ceuta and Tangier; and extending southward to Mogador, and inland to the Atlas.. The Rif Berber element is composed of the Bezirker-Rif, the Bezirk-er-Gart, and the Isnaten, the last bordering on Algeria. The Rifs are of mid-stature, strong, broad-shouldered. They live by fishery, and by wrecking; and robbery and murder are common. Some enlist as Zouaves in the Spanish garrisons on the Morocco coast. The northern part of the Atlas is occupied by the Berbers, who for the most part are unmixed with Arab, and are slender, often over mid-height, and uncommonly muscular; the face is long, with a somewhat Roman physiognomy, and, though the tint becomes darker toward the south, the features preserve the Berber type, save where there is negro admixture. The Schloch Berbers, south of the parallel of Mogador, inhabit the lowlands as well as the mountains. They are never blond-haired like the other Berbers, but are civilized, and given to trade and handicrafts. Toward the east they become mingled with negro peoples, producing the Charatin or Draa.

King Menelik, formerly King of Shoa, is now Negus of Abyssinia, and the Italians, who favored his pretensions, have succeeded in making advantageous treaties with him, considerably enlarging the area placed under the protection of Italy.

A map of the caravan route from Zeila (British) to Ankobar, showing the routes followed by various travellers, and marking the boundaries between the Somali tribes and the Afar or Galla, is given in a recent issue of *Petermann's Mitt.*

The April issue of the *Proceedings of the Royal Geographical Society* contains an account of the explorations conducted by Mr. T. Last, as leader of the expedition to the Namuli Peaks, and the narrative is aided by a map of the part of East Africa lying between the Rovuma and the Zambezi.

Dr. Zintgraff, in his journey from the Cameroons to Adamaua in 1888–'89, had to force his way through the territory of the Banyanga, was compelled to stay three months in the land of the Bali, and in April reached that of the Bafut. On account of a threatened attack, he had to make his way through a comparatively uninhabited country. At Donga his surveys met those of Flegel. On June 11, 1889, he was at Ibi, on the Benue, whence he proposed to proceed to Jola, and then return to Bali-land.

Dr. Schweinfurth gives a full account of the excavations carried on by Flinders Petrie in the Fayoun, in *Petermann's Mitteilungen*, Part II., of this year.

A. Sharpe, in an account of his trip in the region between the Shire and Loangwa rivers, mentions that the Kirk mountains are merely the abrupt edge of the highlands that stretch to the west of the Shire valley. The Oughat or Achewa tribes have to a great extent been driven away or enslaved by the Angoni (Zulus), so that the remaining Achewas stand in great fear of the Zulus. The names of places in South Africa change as the chiefs change: thus Undi, four days west of Lake Nyassa, is named from an Achewa chief.

Petermann's Mitteilungen, 1890, Part I., contains an account of the journey of Dr. K. W. Schmid in the Comoro Islands, with a map of Angasija, or Great Comoro, and of Mohilla. The latter island is entirely covered with vegetation, but wherever the rock could be seen it was tufa. The whole eastern coast of Angasija is without a harbor, but on the east coast there is a good harbor at Mroni Bay, slightly to the north of the great volcano. The island extends about 40′ north and

south, and is quite narrow, increasing in width at its southern extremity, where it reaches 18 to 20 miles. It comprises several little sultanates. The volcano, 2250 metres high, is at the southern broad end about equidistant from each of the shores. Its crater is oval, the wall broken north and south by a lava stream.

Asia.—M. Bonvalot is now at Lob-Nor. He intends to cross Tibet, and follow the Yang-tse from the sources.

Beluchistan is now wholly British. The natives of the Zhob and Gamul valleys, and also the Wazuris, have made submission. The Zheb valley is an alluvial plain, at an average elevation of 4800 feet, and is well supplied with water, at least in the vicinity of the river. Much of territory lying between that of the Amir and what was previously British has thus now fallen into the hands of the latter. The British headquarters are now at Apozai.

H. S. Hallett considers that the earliest invaders who disturbed the repose of the aboriginal Negritos of Indo-China were the Bau of the Shan States, the Mon of Lower Burma, and the Cham of Cambodia, all of whom are Mongoloid with Malay affinities, and in West Bengal and Central India are represented by the Kolarian tribes. The La-Hu and Kiang-Tung La-Wa are said to be kindred to the white races, and were established upon the south bend of the Hong-He when the Chinese came from Chaldæa. They gradually amalgamated with their conquerers, and imported to the latter their folk-lore. The guardian spirits worshipped by the Shans are those of the ancient La-Wa kings and queens during the long wars that endured between the La-Wa and the Shans.

M. Venukoff (*Revue de Geog.*, April, 1889) asserts that the English have placed a garrison in a fort at Schahidulla, on the north side of the Karakorum range, and so near to the possessions of the Chinese in Kashgaria (Yarkand and Khotan) that they in alarm have also built a fort. Great Britain has also two other small forts northwest of the Indus, at the south foot of the Hindu Kush, and not far from the sources of the Oxus.

In Russian Turkestan an avalanche of rocks, a kilometre long, half a kilometre wide, and 100 metres thick, has fallen into the valley of the Zarafshan, and has blocked up the river, forming a lake twelve kilometres in length, threatening the district with submersion.

Salanga is a small archipelago on the western coast of Malaca, and, like Larut and Perak, is rich in tin mines. This has caused its peo-

pling by Chinese, who in 1889 numbered 40,000, while there were but 1500 natives and 500 Malays. The tin-bearing layer lies at the base of an unctious clay of varying thickness, which is itself below alluvial deposits of varying depth.

Petermann's (Part III., 1890) gives a map of the course pursued by A. Jakobsen from Flores to Kalao, Tana, Diampia, Pulo Salăyer, and other small islands north of Flores. The same traveller proceeded westward to Adenare Islands.

B. Moritz contributes to the *Zeitschrifft der Gesellschaft fur Erdkunde* a paper upon the new Turkish province of Hedjaz, and the route from Mecca to Medina. The population of Hedjaz has been estimated at 700,000, but our author deems these figures too high. The nomad Bedouins are not more than 27,000 strong. Mecca has 110,000 inhabitants, Medina 40,000, Jeddah 20,000, and all the remaining towns are small. The area of the province is 1,193,517 square kilometres.

In 1888 the population of Hindustan, including Birma, was 269,-477,728, or a mean density of 185 per square mile. In Bengal there are 443 persons on every square mile, in the Northwest Provinces 416, and in the central tributary states 215. Birma is the most sparsely peopled, and next to this the vassal states of Bengal, and the districts of the extreme northwest.

There are twenty thousand so-called "Mountain Jews" in the Caucascus. They have singular beliefs and superstitions, showing Persian influences, but for centuries they have had no communication with the rest of their race.

Thanks to the facilities now afforded by the Japanese government for the colonization of Hekkaido (Yesso), there was in 1888 more than seventy-seven times as much cultivated land as in 1876. The latest populations (1887) of the chief cities of Japan are as follows: Tokio, 1,165,048; Osaka, 432,005; Kioto, 264,559; Nagoya, 149,756; Yokohama, 115,612; Kobe, 103,969. The total area of the islands is 382,421 square kilometres, and the population 39,069,007, of whom 19,731,354 are men. There are 76,624 Christians, and 543 foreign missionaries.

Lieutenant Roborowsky sends from the oasis of Nice a continuation of his account of the doings of the Russian expedition under Colonel Pievtsoff. Accounts of Central Asian journeys are, as a rule, monotonous, but this is enlivened with a legend of a Mohammedan feminine saint, who, being pursued by heathen, prayed to God, and was answered

by the earth opening and swallowing her all up except her long plait of hair, which is still visible (to the head mallah only). By a new pass, the expedition will enter Tibet during the present summer. The botanical collection of Roborowsky contains 430 species.

Miscellaneous Geographical News.—The Peruvian government have despatched an expedition to the river Javary, on the borders of Peru and Bolivia, in order to chastise the Indians for the murder of of white traders. As the party includes among its members five scientific men, among whom is the well-known Richard Payer, some useful results may be looked for.

According to Venukoff, the increase in size of the delta of the Neva is small compared with that of the deltas of the Danube, Rhone, and Volga. The water of the river is comparatively free from sediment, because the principal tributaries deposit their load in Lake Ladoga, which is only sixty-five kilometres distant from the Gulf of Finland.

According to Dr. Hettner, two different peaks have been confused under the name of Coropuna. The peak called Coropuna at Arequipa seems to be higher than the true mountain of that title—which also bears the names of Arupato and Salmancay (Indian)—and is probably the highest of the entire volcanic range,

The republics of Central America propose to unite under the title of the United States of Central America. The president is to be elected annually, and to be furnished by each of the States in turn. The federal capital is to be Tegucigalpa, the capital of Honduras. The Congress will be composed of eighteen deputies, one for each 200,000 of the population, and the first meeting is to be on Sept. 15, 1890.

Dr. A. Phillipson contributes to *Petermann's Mitteilungen* of this year an account of the various elements which compose the existing population of the Peloponnesus. The Goths and other barbarian hordes ravaged and departed, so that the first immigrants who came to stay in considerable numbers were the Slavs. At the beginning of the thirteenth century the bulk of the population consisted either of New Greek, otherwise called Byzantine or Rhomæi, who inhabited the cities, especially those of the coast, and of New Greek mixed with Slav, scattered all over the country. The old Hellenic element persisted, however, in a nearer approach to purity, in Mani and Tzakonia, while the Slavic was almost pure in Arcadia and Taygetos. The Greek language eventually predominated over the Slav. Later on

came the irruption of the Arnauts or Albanians. The result is, that at the present time the old Hellenic blood has entirely disappeared, and all the people of the peninsula are more or less mixed. About 90,000, chiefly at or near Corinth, and on the Ægean coast, still speak Albanian, but all the rest of the inhabitants use modern Greek.

Dr. Hickson has published an interesting book, giving the results of his residence, for nearly a year, upon a small island off the extreme north coast of Celebes. During this stay he made excursions to the northern part of the main island, and also to Nangir, Nanusa, and Talant, small groups between Celebes and the Philippines. About half of the book concerns the northern part of Celebes, especially treating of the mythology and customs of the natives.

The greater part of the island erupted in 1885 in the Tonga group (Falcon Id.) has disappeared, and the existing island is a shelving bank to the northeast of it. The volcanic debris may now form a platform upon which a coral reef, and ultimately an atoll, may be built up.

GEOLOGY AND PALEONTOLOGY.

Newberry's Paleozoic Fishes of North America.[1]—In this volume we have collected descriptions of the fishes of the Paleozoic formations of North America, which have been discovered by Professor Newberry since the publication of his report of the geological survey of Ohio, with a few others. The species there described, as well as those described in the report of the geological survey of Illinois, by himself, Mr. St. John, and Prof. Worthen are only enumerated; and those described from the Permian beds of Illinois and Texas, by the present reviewer, are not mentioned. Add to this the fact that no bibliographic references appear, and we see that Professor Newberry has not intended this work to have the characteristics of a complete monograph. It is therefore that we welcome it as a collection of descriptions of numerous remarkable forms of early fish-life discovered by the author, which will greatly advance our knowledge on the subject. This branch of paleontology is an important one, representing as it does our knowledge of the earliest-known Vertebrata, and including as it must the ancestral types of all later forms.

[1] The Paleozoic Fishes of North America, by John Strong Newberry. Monograph No. XVI., U. S. Geological Survey. Pp. 228, plates LIII. Washington, 4to, 1889. Received July, 1890.

The volume is divided into three parts, viz.: I. On the Fishes of the Silurian System; II. On those of the Devonian; and II. On those of the Carboniferous System. The number of species referred to, and the number described in the divisions of these systems, is as follows:

SILURIAN SYSTEM.

	Enumerated.	Described.
Onondaga Salt Series,	2	0
DEVONIAN SYSTEM.		
Corniferous,	20	14
Hamilton,	8	8
CARBONIFEROUS SYSTEM.		
Chemung,	9	9
Catskill,	9	9
Waverly,	48	5
Cleveland Shales,	28	26
Carboniferous Limestone,	347	14
Coal Measures,	27	2
Total,	498	87

Among the eighty-seven species described are a number of very interesting ones, several of which are referred to new genera. From the Corniferous series we have Acantholepis and Acanthaspis Newb., which the author thinks to be allied to Cephalaspis. From the Hamilton, Goniodus Newb., probably a Cestraciont shark; and Callognathus Newb., small forms allied to Dinichthys. From the Chemung, Holonema Newb., based on the *Pterichthys rugosa* of Claypole, a remarkable Placoderm of large size. From the Cleveland Shale, Titanichthys Newb., a member of the Dinichthyidæ, but different from Dinichthys in the slender edentulous jaws, with two species; Glyptaspis Newb., another Placoderm belonging to the Dinichthyidæ; Mylostoma Newb., another member of the same group, with flattened grinding surfaces on the extremities of the dentary bones; Trachosteus, an ally of the same family; and Actinophorus Newb., apparently a very primitive representative of the modern superorder of the Actinopterygia, and therefore a very interesting discovery. The Waverly produces the new genus Mazodus Newb., which is based on the flat-grinding teeth of some Cestraciont shark of large size. To the fauna of the Carboniferous Limestone is added the genus Cœlosteus Newb., based on a mandibular ramus, with shallow alveolæ for large teeth, probably

allied to Rhizodus. Important discussions of the characteristics of the best-known Paleozoic genera are entered on, especially of Macropetalichthys, Onychodus, Bothriolepis, Dinichthys, Titanichthys, Mylostoma, and Edestus.

In the discussion of the affinities of these and other genera, the zoologist who has gone beyond the views held in the days of the elder Agassiz will find a good deal to criticise. In fact, modern taxonomic views do not seem to have taken much hold on the mind of Professor Newberry up to the time of writing this book. The principal source of error is the tendency to compare the extinct with very different recent forms, to which they may have some superficial resemblance. This is a tendency much more praiseworthy than the opposite extreme that prevails among paleontologists—that is, the habit of neglecting existing forms, as though all of the latter have originated in modern times, which we well know is not the case. However, when Prof. Newberry compares Macropetalicthys with the sturgeons, he is certainly wide of the mark. This genus is a Placoderm, allied to Homosteus, and the areas on the cranium indicated by Prof. Newberry as separate elements, comparable to those of the true fishes and Batrachia, are not such, but are merely the spaces inclosed by the tubes of the lateral line system. (See Fig. 2, p. 43.) The true cranial segments are different, as I hope soon to show. As to the Dinichthyidæ, Professor Newberry follows Huxley in referring them, and of course other Placodermi, to the neighborhood of the Nematognathi of modern waters. Since the discovery of the dorsal fin in Coccosteus by von Koenen and Traquair, it is evident that the resemblance to the Siluroids is scarcely even superficial. In describing Cœlosteus, Prof. Newberry regards it as allied to Pappicthys, and the order of the Halecomorphi; but this cannot be accepted, as the character of the ossification is that of various truly Paleozoic types, and the general characters approach especially to Rhizodus.

In commenting on Macropetalichthys, the author asserts that the absence of lower jaw need not be regarded as a character of much importance, as is done by Haeckel and others. In this zoologists will probably agree with Professor Haeckel, and will make the systematic inferences from it which it warrants in the case of the Pteraspididæ, for example.

In his conclusion that the remarkable structures to which the name Edestus has been applied are median dorsal procumbent spines, ichthyologists will agree that Prof. Newberry has given the most plausible of all the attempted explanations yet offered.

The most complete description of structure of any of the genera enumerated, is that of the genus Dinichthys Newb. The elements of the skull and shield are pointed out, and its affinity to Coccosteus Ag. is demonstrated. Prof. Newberry shows that the eye had an osseous capsule, whose intimate structure considerably resembles that of some existing forms, as the sword-fishes. He describes a foramen which has the position of the pineal foramen of some reptiles; and shows that the eyes were protected by a ring of large bony sclerotic plates. A good deal of light is thrown on the structure of the fins. Thus Prof. Newberry believes that pectoral spines exist. If this be true, the family Dinichthyidæ may be regarded as distinct from the Coccosteidæ, where Traquair shows that they are absent. Dorsal fin elements are described from what are regarded as probably basilars. Their connections with the axial and vertebral elements are not known, but so far as they go they resemble the elements described by Von Koenen in Coccosteus, and indicate a wide difference from the structure of the Siluroids or any other Actinopterygian fishes.

The comb-like bodies found in Ohio coal measures with fishes and Stegocephalous Batrachia, originally described by the present critic in the Proceedings of the Amer. Philos. Soc., are redescribed by Prof. Newberry. He is not persuaded that Fritsch, who first found them in the Permian bed of Bohemia, has correctly referred them to the genitalia of the Stegocephali, but he is inclined to think them the teeth of fishes.

The fifty-three plates that accompany the text greatly elucidate the subject. We are sorry that they could not have been better executed, but the fault is not Prof. Newberry's. The method of illustration by phototype process has not yet attained perfection, and until it does, and so long as the U. S. Geological Survey insists on using it, there must be some scapegoats.—E. D. Cope.

Chinese Accounts of the Mammoth.—The gradual cooling of the Asiatic climate may be supported by the existence of the bones of the mammoth in northern Siberia. This hairy elephant lived in that country when the air was temperate, and when abundant forests supplied it with the young twigs on which it lived. Since that time northern Siberia has become an intolerably cold desert. The ground there is constantly frozen to a depth of more than two feet below the surface, and produces only moss, with a few modest-looking flowers. The mammoth very early drew the attention of the Chinese. It is first mentioned in the *Er-ya*, and next in Chuang-tse, in the third

century before Christ. The enormous quantities of valuable ivory which the remains of the mammoth in Siberia furnish made known to the ancient Chinese the existence of the animal through their trade with Tartary. On account of its being found in very many localities imbedded in the soil and in rocks, old books always speak of it as a monstrous mole living underground. It was found, they tell us, in China and in Tartary. Chuang-tse wrote as a poet, and pictures it (*yen shu*) as drinking a river of water before its thirst was satisfied. He had been told of the fossil bones or had seen them, and filled up the picture by the aid of imagination, either his own, or that of those from whom he heard the story. Seven centuries afterwards a medical writer, Tao Hung-king, says: "It is found in forests, and is as large as a water buffalo. It is in form something like a pig. Its color is a greyish-red. Its feet are like those of the elephant. Its breast and upper tail are white, and blunt though powerful. Its flesh is eaten, and is like that of the cow. It is known by the name 'King of the Shu tribe.' In calamitous years this animal often appears."

In the seventh century this account of the animal was discredited. Its great size was not believed. Its hiding and walking in the earth were thought absurd. These disparaging criticisms were made by Chên T'sang-chi, an eminent writer, who does not seem to have been shown any of the bones of the animal. Yet in the eleventh century Su Sung defended the statements of early writers on the subject. Bones of some large unknown animal had been found at T'sangchou, near Tientsin, just as the *Tsin* History states that at Siuencheng, a little way southwest of Nanking, there had been found similar remains in the third century. It was also related that the same animal existed in Tartary, where the larger specimens weighed one thousand catties, and was fond of living in water. It was like an elephant in the legs, though it had the hoofs of a donkey. Another place where it was found was at Tsiuning, near Pingyang Fu in Shansi. The people called it the "recumbent cow." It used to wander among the mountains at times, and drop its hair in the fields. Each one became a rat, and great was the damage to the crops. The Liang history says that in Japan there is a large animal like a cow of the Shu class, which is eaten by a great serpent. These are all instances of the mammoth ("hidden, *shu*") and prove the correctness of Tao's words. Tao has been blamed without reason by men who had not themselves inquired into the truth of his statements. The name by which this animal is known in Shensi is "the small donkey." Such are the testimonies of the existence of the mammoth collected by the author of the *Pent'sao*.

The Chinese accounts of a monster animal as given in the *Pent'sao* could not, if taken alone, be regarded as agreeing with the Siberian mammoth except in a rough way, yet they are very important. Early in this century the remains of that animal were found in so many parts of Siberia, and the ivory was of such great commercial value that the whole scientific world was interested. Cuvier in France was absorbed in the contemplation of the remarkable bones submitted to him, and decided that as the mammoth was met with often with the flesh undecayed, there must have been a sudden change of climate from temperate to extremely cold to account for the frozen condition in which the remains were found. Klaproth, who was then at Kiachta, visited the Chinese drug shops and found that the bones were known to the Chinese there. They gave him the name of the animal as it was recorded in the *Pent'sao*. It was he that suggested that the throne of ivory of the Mongol Emperors was formed of the tusks and teeth of the Siberian mammoth, and that Chinese traders for two thousand years would be ready to buy on any occasion the ivory which was from time to time discovered and brought away. He went home to Berlin, and made known to the learned world that the Chinese had accounts of the animal. The passages he translated are apparently those which are found in the *Pent'sao*, in the chapter on the class *Shu*, which includes the Rodentia with the squirrel, sable, ermine, and weasel. There can be no doubt that the mammoth, and possibly other fossil animals known to the Chinese, are assigned to the class *Shu*, because they were supposed to hide themselves in the soil of cultivated fields, and to have died underground in the position where their bones were afterwards found.

In a work published in 1887, "Mammoths and the Flood," by Henry Howorth, M.P., author of "A History of the Mongols," the attempt is made to prove that the change of the Siberian climate from mild to severe was sudden. Lyell's uniformitarian doctrine is opposed. Yet the evidence from China of a gradual change of climate in that country was not known to this author, and if he had had this evidence before him, showing as it does that there is a very slow refrigeration taking place, causing gradual changes in the vegetable as well as the animal world, he might have modified his theory. Perhaps the best form for the hypothesis to assume is that of a rapid local refrigeration in Siberia, joined with a slow refrigeration generally over the Asiatic continent. The Chinese facts on climate point distinctly to a slow refrigeration, but do not in any way suggest a sudden catastrophe by which the heat shown by the thermometer was reduced to a

large extent. The Chinese mammoth has been found in four principal localities: in the Yellow River alluvium near Tientsin, in the loess formation near the centre of Shansi, in Shensi, also on the banks of the Yangtze River in Anhui. It was this last discovery that drew the attention of Tau Hung-king, who belonged to Nanking, and being a noted Taoist, and a writer of the school of Pao Pu-tsz, would feel the deepest interest in the discovery so near his home.—*North China* (*Shanghai*) *Herald.*

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The results of the investigation of the clastic, metamorphic, and eruptive rocks of the Coast Ranges of California, promised by Mr. Becker a few years ago,[2] have recently[3] appeared in an extended form. The principal conclusions of the study have already been referred to in these notes. The proofs which Mr. Becker offers for the correctness of the statements that many serpentines of the Coast Ranges are altered sediments will probably be accepted by most petrographers as sufficient. His conclusion that typical diabases, diorites, and gabbros are likewise derived from clastic materials will not find such ready acceptance, as there seems to be no positive evidence that such rocks were originally sediments, rather than eruptives, which squeezed themselves into fragmental beds, and so caused the formation of a graded series, with sandstone at one end and a holocrystalline rock at the other end. There is no reason to suppose that holocrystalline[4] rocks may not have sometimes originated by metasomatic alteration of fragmentals; but the belief that a rock with the peculiar structure of diabase has originated in this way will require stronger proof for its acceptance than that offered in Mr. Becker's monograph. The presentation of a few illustrations of types of rocks intermediate between the sandstones and the diabases (pseudodiabases of Becker, metadiabases of Dana) would have aided materially in enabling readers of the volume to draw their own conclusions as to the origin of the rocks in question. In the discussion of the massive rocks of the region, the term asperite is proposed as a general one to include all andesitic rocks with a rough trachytic habit. In this

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] AMERICAN NATURALIST, Aug. 1886, p. 724.

[3] Monographs of the U. S. Geol. Survey, Vol. XIII., pp. 56-175.

[4] Cf. Van Hise. AMER. NATURALIST, 1886, p. 723.

portion of the volume are also described andesitic and basaltic glasses, which are much more acid than the holocrystalline rocks with which they are associated. The basalt glass has the composition of an obsidian, and passes into a rock with the appearance of basalt. Analyses I. and II. are of obsidian and basalt respectively:

	SiO_2	P_2O_5	TiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	NiO	CaO	MgO
I.	75.40			7.72	1.41		.12		1.55	1.26
II.	57.37	.02	.60	15.66	2.06	4.46.	.27	.41	4.94	8.84

	Na_2O	K_2O	Cl	H_2O	Sp. Gr.
I.	8.00	4.52	.12	.43	2.39
II.	3.05	1.50		.74	2.83.

The difference in structure of the two rocks is supposed to be due to differences in composition of the original magma.——As an introduction to his description of the minerals of the syenite-pegmatite veins of Southern Norway, Brögger[5] gives a short account of the geology of the region in which these veins occur, and gives his reasons for regarding the lattter as eruptive in origin, as against the lateral secretion theory proposed to account for them. Since the article is itself an abstract of a monograph on the geology of the region, it is difficult to give a résumé of its contents. Among the rocks discussed are some new types, to which reference may be made. Laurvikite is a typical augite-syenite composed of anorthoclase (or cryptoperthite) diopside, ægerine, and lepidomelane, with small amounts of barkevikite, olivine, sphene, magnetite, apatite, zircon, nepheline, cancrinite, and sodalite. It is granitic in structure, except on its periphery, where it is developed as the well-known rhombic porphyry. This latter occurs also as dykes in the former and as flows. A variety of the laurvikite, in which oligoclase is present in addition to the anorthoclase, and in which the latter mineral has rectangular rather than the rhombic cross sections which characterize it in the laurvikite Brögger calls augite-mica-syenite, since it contains very little nepheline. Another rock very characteristic of the region is called laurdalite. This is a coarse-grained nepheline-syenite, with or without olivine. It contains more nepheline and sodalite than does laurvikite, and the former mineral is porphyritically developed. It is the rock described by the author as nepheline-syenite[6] in a former publication. The dyke rock corresponding to laurdalite is a nepheline-rhombic-porphyry, which differs from the porphyritic laurvikite in containing nepheline in its

[5] *Zeits. f. Kryst.*, etc., XVI., 1890.

[6] Silur. Elagen, 2 and 3, p. 273.

ground-mass. Three other varieties of dyke rock corresponding to laurdalite are recognized. The first is granitic, and is called ditroite; the second is trachytic in structure, and has been denominated foyaite; while the third has phenocrysts of elæolite in a granitic ground-mass. This a nepheline-porphyry. Hedrumite is trachytic, but it contains no elæolite, or, if any, but a small quantity. A tinguaite variety of these rocks is also recognized. Among the acid rocks a quartz-bearing augite-syenite is distinguished by the name akerite. This rock is composed of orthoclase, plagioclase, a large amount of brown biotite, idiomorphic diopside, nepheline, sodalite, usually olivine, and nearly always quartz. Its structure is granitic, and its peripheral facies is a quartz-porphyry. Several varieties of the rock were discovered, one of which is a hypersthene-akerite. More acid than akerite is nordmarkite, which is a quartz-syenite, consisting of microperthite, a diopside pyroxene, biotite, glaucophane or ægirine, and arfvedsonite, sphene, and a little zircon. It is granitic, with quartz in ordinary granite form. Since the rock contains less than 66% of SiO_2 it is called quartz-syenite, rather than soda-granite. The corresponding effusive rock is a quartz-rhombic-porphyry, with a poicilitic ground-mass of quartz and feldspar. Soda-granite is developed in several varieties, among which hornblende, arfvedsonite, and ægirine varieties are the most important. The structure of the rock is not strictly granitic, consisting, as it does, of a ground-mass composed of short rectangular orthoclase, quartz, needles of ægirine, apatite, etc., with a few phenocrysts of microcline and ægirine. The author proposes that the rock be called grorudite. Very many more special phases of these various rocks are recognized, but a full description of them is left to the promised monograph. The larger part of the introductory portion of the volume is occupied with arguments to show that the pegmatitic veins so common in South Norway, as well as in other regions of old rocks, are true fillings of fissures by what was once a molten magnea.——Toula[7] announces the results of the examination of rocks collected during several trips through the Balkans. The rocks of the Central Balkans are divided into massive rocks and crystalline-schists, among the former of which granite, diorites (including nadel-diorite), uralite-diabase, microgranite, orthophyres, porphyrites, pepheline-basalt, limburgite, and andesitic and porphyritic tufas are described; among the latter granitic, hälleflinta and other gneisses and quartz-phyllites are mentioned. In the Eastern Balkans are fossiliferous sandstones and limestones and eruptive rocks, including granites,

[7] *Neues Jahrb. f. Min.*, etc., 1890, II., pp. 263, 273.

diorites, porphyrites, quartz-porphyry, andesites, and trachytes of various kinds, phonolites, augitites and tufas.——Lacroix[8] announces the discovery of a peculiar rock, composed of garnets, quartz, orthoclase, oligoclase, nitite, and diaspore, occurring in blocks cast from a volcano near Bournac in the Auvergne.——Mr. Nason[9] gives a brief description of the crystalline rocks occurring in the Highlands of New Jersey.

New Minerals.—In addition to the numerous new minerals lately discovered by Börgger in the Scandinavian Peninsula, five others have recently been described. These latter are from Sweden; the discovery of them is due to Igelström.[9]——*Talcknebelite*, from the iron mine Hillång, Ludvika Parish, Gouvernement Dalekarlien, is associated with small red garnets. In appearance it resembles *igelströmite*, but is lighter and has a pearly lustre on a fresh fracture. In composition it is a magnesium bearing knebelite as follows: $SiO_2 = 33.1$; $FeO = 42.6$; $MnO = 21.6$; $MgO = 4.7$.——*Ferrostibian* has been found imbedded in massive rhodonite at the Sjögrufvan Mine, Grythyttan, Oerebo. The crystals are quite large. They are probably monoclinic, and bounded by oP, $\infty P \overline{\infty}$ and $\infty P \grave{\infty}$. They are black and opaque, with a brownish-black streak, and are weakly magnetic. They have a hardness of 4, and in thin section are blood red in color. The mineral dissolves with great difficulty in the usual reagents. An analysis gave:

SiO_2	$(MgCa)Co_3$	Sb_2O_5	FeO	Mno	H_2O
2.24	2.14	14.18	22.60	46.97	9.19

Regarding the silica and carbonate as impurities, and the manganese and iron as in the "ous" condition (which could not be proven), the analysis may be expressed by the formula $10\ RO.\ Sb_2O_5 + 10\,(RO.\ H_2O)$.——*Pleurasite* is a hydrate arsenate from the same mine. It is implanted in arseniopleite. It is bluish-black and opaque, but in thin section becomes pale red. It has a half metallic lustre, a black streak tinged with red, and a hardness of 4, and is very weakly magnetic. It dissolves readily in dilute hydrochloric acid, and yields a yellow solution. Analyses have not yet been made, but qualitative tests indicate that it is a hydrated manganese iron arsenate, containing some antimony.——*Stibiatite*, also from the same mine, occurs in small crystals imbedded in polyarsenite and in irregular grains in veins of various minerals cutting the manganese ores of the mine. The crystals appear

[8] Bull. Soc. Fran. d. Min., Jan. 1890, p. 7.

[9] Ann. Rep. State Geologist of New Jersey for 1889, p. 30.

[9] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 248.

to be orthorhombic. They are raven black and perfectly opaque even in the thinnest sections. They are easily soluble in hydrochloric acid and are not magnetic. An approximate analysis gave: $FeO = 26$; $Mn_2O_3 = 44$; $Sb_2O_5 + H_2O = 30$.——*Neotesite*, also from the Sjögrufvan, occurs in lamellar masses associated with tephroite, pyrrhoarsenite, and calcite. It resembles in appearance red orthoclase. It has a good cleavage, a hardness of 5–5.5. It is soluble in acids, leaving a residue of flocculent silica. Its composition:

SiO_2	MnO	FeO	MgO	H_2O
29.50	40.60	tr.	20.05	9.85

corresponds to $(MnMg)_2SiO_4 + H_2O$, *i.e.*, to a hydrated tephroite. The author, however, does not regard it as a decomposed tephroite.——*Antlerite* is a light green, massive mineral from the Antler Mine, Mohave County, Arizona, which, according to Hillebrand,[10] has a specific gravity of 3.93, and a composition as follows: $CuO = 67.91$; $ZnO = 16.5$; $CaO = .05$; $SO_3 = 20.77$; $H_2O = 10.93$, corresponding to $3\,CuSO_4 + 7\,Cu(OH)_2$.——*Selen-tellurium*, from El Plomo Mine, Tegucigalpa, Honduras, is nearer in composition to native selenium, according to Messrs. Dana and Wells,[11] than any substance known. It is regarded as an isomorphous mixture of the two metals indicated by its name, in the proportions $Se = 29.31$, $Te = 70.69$. It occurs massive, has an indistinct columnar structure, and is blackish-gray in color. Its cleavage indicates hexagonal crystallization.——*Durdenite*, a greenish-yellow mineral associated with native tellurium, is thought by the same authors to be a ferric tellurite corresponding to $Fe_2(FeO_3)_3 + 4\,H_2O$, but differing from the ferric tellurite described by Hillebrandt under the name emmonsite.——*Hamlinite.*—Messrs. Hidden and Penfield[12] describe a rhombohedral mineral occurring at Stoneham, Maine, in small crystals, associated with herderite, margarodite, and bertrandite. The material available for study was so small that no chemical analysis of it was possible. The crystals are bounded by oR, R, and —2R, with oR predominating, $a : c = 1 : 1.135$. The cleavage is perfect, parallel to the base, and the lustre on this face is pearly, while on the rhombohedral faces it is vitreous and greasy. The double refraction is weak and positive. Hardness = 4.5; Sp. Gr. = 3.228. Blowpipe tests prove the mineral to be a phosphate of beryllium and aluminum containing fluorine.——*Phosphosiderite* is a new mineral from

[10] Bull. U. S. Geol. Survey, No. 55, p. 48.

[11] *Amer. Jour. Sci.*, July, 1890, p. 78.

[12] *Amer. Jour. Sci.*, June, 1890, p. 511.

the Kalterborn Mine, near Eiserfeld, Siegen.[13] It is in the form of blood red or reddish-violet aggregates lining cavities in an iron ore. It is transparent, and has a hardness of 3.75, and a density of 2.76. In the glass tube it becomes yellow and opaque and loses water. Dissolves in hydrochloric acid, but is almost insoluble in nitric acid. An analysis gave $Fe_2O_3 = 44.30$; $P_2O_5 = 38.85$; $H_2O = 17.26$, corresponding nearly to $2Fe_2O_3\ P_2O_5 + 8H_2O$, which is the formula for strengite. The new mineral differs from strengite in containing about two per cent. less water, and in losing all of this in one stage. Phosphosiderite is orthorhombic, with $a : b : c = .5330 : 1 : .8772$. The cleavage is parallel to $\infty P \breve{\infty}$, which is the predominant form. Prismatic forms are also largely developed. Twins, with $P\bar{\infty}$ the twinning plane, are met with. The mineral is optically positive, with $\infty P \breve{\infty}$ the axial plane and c the acute bisectrix, $2V_{na} = 62°4'$ and $\rho > \upsilon$. Pleochroism is $a =$ pale rose, $b =$ carmine, $c =$ colorless.

Miscellaneous.—The U. S. National Museum has just published two pamphlets of some interest. One is by Mr. Kunz,[14] and contains a readable account of the gems in the possession of the institution. The second is of more special interest to mineralogists. It is a complete catalogue of mineral names, with their synonyms in French, German, and other languages. The volume is by Dr. Egleston,[15] of Columbia. It is intended to serve as an aid to those who arrange and keep in order large collections of minerals, a purpose that it will surely serve.——The first part of volume second of the Report of the Geological Survey of New Jersey[16] contains a full list of the minerals found in that State.——The well-known instrument maker, Fuess,[17] has recently given very full and clear descriptions of some petrographical microscopes manufactured by himself after suggestions offered by practical mineralogists and petrographers, and of some newly-constructed apparatus for use with these. The most novel of the latter are an axial angle apparatus and a goniometer attachable to the stage of the microscopes.

[13] Bruhus and Busz: *Zeits. f. Kryst.*, XVII., 1890, p. 555.

[14] Rep. Smith. Inst., 1885–6, Pt. II., p. 267–275.

[15] Bull. U. S. Nat. Mus., No. 33, Wash., 1889.

[16] Geol. Sur. of N. J. Rep. of State Geol., Vol. II., Pt. I., Trenton, 1889.

Neues Jahrb. f. Min., etc., BB. VI., 1890, p. 55.

MICROSCOPY.

Methods for the Preservation of Marine Organisms Employed at the Naples Zoological Station.—Unfortunately for our students, especially those living inland and depending largely for their knowledge of marine forms upon dried or preserved specimens in museums, the old-fashioned methods of throwing any material which the collector may find into a jar of alcohol without further attention, or else drying it in the sun, are still almost the only ones made use of for the preservation of museum specimens. The result is that the majority of forms which the student has for study are either dried skeletons, or shrivelled up monstrosities giving no idea whatever of the actual appearance of the creatures supposed to be represented by them. How many college museums possess a specimen of coral showing in any recognizable form the polyps by which the skeleton coral was formed? Or how many have even a satisfactorily prepared Lamellibranch?

There are, however, in this country, a few collections which show a marvellous improvement in their manner of preparation, and which have been purchased for the Naples Zoological Station, whose conservator, Salvatore Lo Bianco, has, for several years, been devoting himself to the discovery of the best methods for the preservation of the form and color of the marine animals occurring in the Mediterranean. Until the present, however, his discoveries have not been made common property, except in the few cases where the most successful methods of preserving certain forms have been published in connection with accounts of their structure. The last number of the *Naples Mittheilungen,*[1] however, contains a full description, by Lo Bianco, of the methods found most successful for the preservation of the various forms which occur at Naples, and which are undoubtedly applicable to the similar forms found upon our own coast. An abstract of these methods is given in the following pages, in the hope that they may be found useful by the museum curators of this country, and that their application may result in the much-needed improvement of the appearance of the specimens found in the majority of our college museums.

It must be fully understood, however, that much depends upon the skill of the preparator, and that want of care and patience will frequently counteract all the advantages to be derived from a good

[1] Mitth. a. d. zool. Station zu Neapel, Bd. IX., Heft III.

method. All who have had the opportunity of examining specimens prepared by Lo Bianco can appreciate readily the great advantages which may result from the careful application of his methods, and can perceive how greatly we are indebted to him and to Professor Dohrn for their publication.

Alcohol is, of course, indispensable as preservative fluid, but certain precautions are necessary in its use. Except in a very few cases it is unnecessary to use it in its full strength, 70% being quite sufficient for preservation, and producing much less contraction and fragility in delicate organisms. Strong alcohol should be reduced with distilled water to the desired strength, ordinary spring water frequently containing a sufficient amount of carbonate of lime and other substances in solution to give a cloudy precipitate, after a time, which may effectually destroy the appearance of a specimen. Furthermore, delicate organisms should first be placed in weak alcohol (35 to 50%) for from 2 to 6 hours, the changing of the fluids being effected by a siphon, a small quantity of the weak alcohol being withdrawn and stronger added, until finally the desired strength is obtained. *With delicate and gelatinous structures the increase in the strength of the alcohol should be as gradual as possible.*

In many cases it is necessary to use a hardening or fixing reagent before the final consignment to alcohol, which is principally useful as a preservative. The most useful fixing reagents, according to Lo Bianco, are the following:

Chromic Acid.—1 per cent. in fresh water. Objects should not remain in this fluid longer than is necessary to fix them, as they are apt to become brittle. Subsequently they should be well washed with distilled water to prevent the formation of a precipitate when placed in alcohol, and also to prevent their taking on too green a tinge from the reduction of the acid.

Acetic Acid, concentrated, kills rapidly contractile animals, but must be used with caution, as it produces a softening of the tissues if they are subjected for too long a time to its action.

Osmic Acid.—1 per cent. solution, hardens gelatinous forms well, and preserves their transparency, but its prolonged action renders the object brittle and gives it a dark brown tint. Objects hardened in it should be well washed in distilled water before being placed in alcohol.

Lactic Acid.—1 part to 1000 parts sea-water fixes larvæ and gelatinous forms well.

Corrosive Sublimate.—Saturated solution in fresh or sea-water; may be used either hot or cold. It acts quickly, and preserves admirably for histological purposes. It is especially good combined with copper sulphate, acetic acid, or chromic acid. Objects hardened in it should be subsequently well washed in distilled water and in iodized alcohol (the recipe for which is given below), to remove all traces of the sublimate, which in alcohol crystallizes out in the tissues of the organisms and so injures the preparation.

Bichromate of Potassium.—5 per cent. solution in distilled water hardens gelatinous organisms slowly, without rendering them fragile. It gives, however, a precipitate in alcohol, and discolors the specimen. The discoloration, however, may be removed by adding to the alcohol a few drops of concentrated sulphuric acid.

Copper Sulphate.—5 per cent. or 10 per cent. solution in distilled water, used either alone or in combination with corrosive sublimate, kills larvæ and delicate animals without distortion. The objects should be subsequently repeatedly washed with water to remove all traces of of the salt, otherwise crystals will form when the object is placed in alcohol.

Various combinations of these reagents are especially useful, and some of those most serviceable are given here:

Alcohol and chromic acid.	
70 per cent. alcohol	equal parts.
1 per cent. chromic acid	
Alcohol and hydrochloric acid.	
50 per cent. alcohol	100 c.c.
Hydrochloric acid, concentrated	5 c.c.
Iodized alcohol.	
35 per cent. or 70 per cent. alcohol	100 c.c.
Tincture of iodine	2.5 c.c.
Chrom-acetic acid, No. 1.	
1 per cent. chromic acid	100 c.c.
Concentrated acetic acid	5 c.c.
Chrom-acetic acid, No 2.	
Concentrated acetic acid	100 c.c.
1 per cent. chromic acid	10 c.c.
Chrom-osmic acid.	
1 per cent. chromic acid	100 c.c.
1 per cent. osmic acid	2 c.c.

Chrom-picric acid.

1 per cent. chromic acid		equal parts.
Kleinenberg's picrosulphuric acid		

Copper sulphate and corrosive sublimate.

10 per cent. solution of copper sulphate	100 c.c.
Saturated solution of corrosive sublimate	10 c.c.

Potassium bichromate and osmic acid.

5 per cent. solution of potassium bichromate	100 c.c.
1 per cent. osmic acid	2 c.c.

Corrosive sublimate and acetic acid.

Saturated solution of corrosive sublimate	100 c.c.
Concentrated acetic acid	50 c.c.

Corrosive sublimate and chromic acid.

Saturated solution of chromic sublimate	100 c.c.
1 per cent. chromic acid	50 c.c.

Frequently great difficulty is experienced in killing an animal without producing a considerable amount of contraction, and in the case of elongated forms, such as Nemertean and other worms, without causing them to coil up or become twisted. To avoid this, it is expedient to narcotize the animals before killing them, and for this purpose Lo Bianco recommends immersion in weak alcohol. He uses generally a mixture of sea-water 100 c.c. and absolute alcohol 5 c.c. In other cases 70 per cent. alcohol may be carefully poured upon the water in which the specimen lies, so that it forms a layer at the surface. It will gradually mix with the subjacent water, and in the course of a few hours will narcotize the animal, so that it may be treated with fixing reagents without fear of contraction.

Chloral hydrate, 1 to 2 parts to 1000 parts sea-water, is also efficient as a narcotizing agent, and has the advantage of allowing a recovery of the animal, if there should be necessity for it, by placing it in fresh sea-water.

For some sea-anemones tobacco smoke is useful, the smoke being conducted by a V-shaped tube into a bell-jar covering the vessel of sea-water in which is the anemone.

Certain of these reagents will prove most satisfactory with some animals, others with others. Lo Bianco details the best method for treating the various forms in a second portion of his paper, and an account of some of his methods of procedure, so far as they concern forms which resemble those found upon our coast, may now be presented.

Sponges.—Direct immersion in 70 per cent. alcohol, with subsequent renewal of the fluid, is recommended for the majority of forms. To avoid contraction in the case of the Halisarcidæ they should be left for half an hour in 1 per cent. chromic acid, or in concentrated solution of corrosive sublimate for fifteen minutes. To prepare dried specimens the sponges should be washed in fresh water for a few hours, and then allowed to remain in ordinary alcohol for a day, after which they may be dried in the sun.

Anthozoa.—The first care must be to place the forms belonging to this group in fresh salt-water, to allow them to expand, a result which may not be obtained until the following day in some cases. Alcyonarians should be killed with chrom-acetic solution No. 2, withdrawing the water in which they lie until there is left just enough to cover them, and then adding a volume of the chrom-acetic solution double that of the sea-water. The animals should be removed from this mixture the moment they are killed, since the acid will quickly attack the calcareous spicules, which are important for the identification of the Alcyonaria, and placed in 35 per cent. or 50 per cent. alcohol, it being well to inject the alcohol into the mouths of the polyps to keep them freely expanded. The preparation should finally be preserved in 70 per cent. alcohol.

Regarding the Actinians no definite rule for preservation can be given. Much of the success of the preparation depends on the form employed, some species contracting much less readily and less perfectly than others. Some may be killed in a fair condition by pouring over them when expanded boiling corrosive sublimate, and then, before consigning them to alcohol, treating for a few minutes with one-half per cent. chromic acid. This method may be employed with small forms such as *Aiptasia*. Narcotization may be tried with others. For this purpose remove from the vessel in which the animals are contained two-thirds of the sea-water, and replace it with a 2 per cent. solution of choral hydrate. After a few minutes the fluid is again removed, and cold concentrated sublimate solution is poured in. Tobacco smoke, in some cases, as with *Adamsia*, will act satisfactorily, if followed with vapor of chloroform for two to three hours, after which the animals may be killed in chrom-acetic, solution No. 2, and hardened in one-half per cent. chromic acid.

Edwardsia may be narcotized by gradually adding 70 per cent. alcohol to the sea-water in which they are, and subsequently may be killed with hot corrosive sublimate.

Cerianthus should be killed with concentrated acetic acid, placing it as soon as possible in weak alcohol, in which it should be suspended so that the tentacles may float freely, if necessary disentangling them.

Corals should be allowed to expand fully, and should then be killed with boiling solution of corrosive sublimate and acetic acid used in volume equal to that of the sea-water containing the coral. The colony should then be transferred to 35 per cent. alcohol, some of this fluid being injected into the mouth of each polyp. The injection should be repeated at every change of the alcohol, and the specimens should be preserved in 70 per cent. alcohol, after washing them well in iodized alcohol.

Hydromedusæ.—For the hydroid colonies the best fixing reagent is hot corrosive sublimate. The smaller Tubularian medusæ should be killed either in the mixture of corrosive sublimate and acetic acid, or in Kleinenberg's picrosulphuric acid. Larger forms may be fixed with concentrated acetic acid, and then allowed to fall into a tube containing the alcohol and chromic acid mixture, in which they are gently agitated and allowed to remain for fifteen minutes, after which they should be transferred to 35 per cent. alcohol and gradually carried to 70 per cent.

Small Campanularian medusæ, *e.g.*, *Eucope* and *Obelia*, may be killed in the mixture of copper sulphate and corrosive sublimate. *Æquorea* should be killed with concentrated acetic acid, and immediately transferred to chrom-osmic mixture for fifteen to thirty minutes. The same method answers for *Cunina*, while *Liriope* should be treated at once with chrom-osmic for five to twenty minutes.

Scyphomedusæ are best fixed with 1 per cent. osmic acid, to the action of which they are subjected until they assume a pale brown tint. They should then be thoroughly washed with fresh water before being placed in 35 per cent. alcohol, and should be finally preserved in 70 per cent.

Siphonophores.—The forms of this group should be preserved soon after capture, and specimens in good condition should be selected. *Agalma* and similar forms should be killed in the mixture of copper sulphate and sublimate, which should be used in volume equal to or double that of the sea-water in which the animal floats. The mixture should be poured in rapidly, and *not* over the animal. When killed, the specimen should be carefully lifted upon a large horn spatula, and transferred to 35 per cent. alcohol for a few hours, and then placed in 70 per cent. It is recommended to preserve the animals in tubes just large enough to contain the specimens and placed within a second lar-

ger tube. In this way evaporation of the alcohol is prevented, and also injury of the specimen from movements of the liquid is avoided.

Physalia should be placed in a cylinder filled with sea-water, the animal being lifted by the pneumatophore. When well expanded it is killed by pouring over it the sublimate and acetic acid mixture (one-quarter the volume of the sea-water), and when dead is transferred to a cylinder containing one-half per cent. chromic acid, and then after twenty minutes to 50 per cent. alcohol, and finally to 70 per cent.

Velella may be killed with chrom-picric or sublimate and chromic acid mixture, and after a few minutes should be transferred to weak alcohol. *Porpita* may be fixed by dropping Klienenberg's picro-sulphuric acid into the vessel in which it is contained, and when the blue color commences to change to red it should be transferred to Kleinenberg's fluid, and after fifteen minutes to weak alcohol.

Diphyes may be killed expanded by hot corrosive sublimate.

Ctenophora may be killed by throwing them into the chrom-osmic mixture, where they should remain for fifteen to sixteen minutes, according to the size, and then gradually passing them through alcohol to 70 per cent. A mixture composed of

Pyroligneous acid, concentrated, ...	1 vol.
Corrosive sublimate solution, ...	2 vols.
One-half per cent. chromic acid, ...	1 vol.

is also recommended as a fixative.

Echinodermata.—Starfish may be prepared with the ambulacral feet in full distension by allowing them to die in 20 to 30 per cent. alcohol.

Echinoids should be placed in a small quantity of water, and killed with chrom-acetic mixture No. 2, being removed from it as quickly as possible, as the acid corrodes the test. To preserve the internal parts it is necessary to make two opposite openings in the test, so that the alcohol may penetrate the interior readily.

Holothurians, such as *Thyone* and *Cucumaria*, after the tentacles are fully expanded, should be seized a little below the bases of the tentacles by forceps, using a slight pressure, and the anterior portion of the body should then be immersed in concentrated acetic acid. Alcohol (90 per cent.) should then be injected into the mouth, and the specimens placed in 70 per cent. alcohol. The injection should be repeated each time the alcohol is changed.

Synapta should be fixed by immersion in a tube containing a mixture of equal parts of sea-water and ether (or chloroform), where they remain completely expanded. They should then be washed for a short

time in fresh water, and passed into alcohol, taking care to increase the strength of this very gradually.

Vermes.—Cestodes, Trematodes, Turbellaria, as well as Nemathelminthes, are most satisfactorily killed with corrosive sublimate, either cold or hot. *Sagitta*, however, succeeds best in copper sulphate and sublimate or chrom-osmic mixture.

Nemerteans should be narcotized in a solution of chloral hydrate in sea-water 1 per cent., where they should remain for 6 to 12 hours. They are then to be hardened in alcohol.

Gephyreans may be narcotized with 1 per cent. solution of chloral hydrate in sea-water, or in alcoholized sea-water, 3 to 6 hours; or else may be killed at once in one-half per cent. chromic acid, which last method may also be applied to *Hirudinei.*

Chætopods are best narcotized in sea-water containing 5 per cent. of absolute alcohol, or by adding gradually to the surface of the sea-water in which they are contained a mixture of glycerine 1 part, 70 per cent. alcohol 2 parts, and sea-water 2 parts, hardening them subsequently in alcohol. *Chætopterus* is best killed with 1 per cent. chromic acid, in which they should remain for half an hour; while the Hermellidæ, Aphroditidæ, and the Eunicinæ may be killed in cold corrosive sublimate. Some of these, such as *Diopatra*, may, however, be narcotized in alcoholized sea-water. Serpulidæ, before treatment with corrosive sublimate, should be narcotized in 1 per cent. chloral hydrate, which causes them to protrude wholly or partly from their tubes.

Crustacea.—Cladocera, Copepods and Schizopods may be killed in corrosive sublimate, dissolved in sea-water. Ostracodes may be thrown at once into 70 per cent. alcohol. Cirripedes die expanded in 35 per cent. alcohol, and if some specimens contract it is easy to draw out the cirrhi with forceps. Amphipods and Isopods may pass directly into 70 per cent. alcohol, except the Bopyrids and Entoniscids, which should be killed in the mixture of equal parts of 90 per cent. alcohol and sublimate solution.

To avoid the casting off of the appendages of the Decapods they should be allowed to die in fresh water, care being taken not to allow them to remain in it longer than is necessary, as it causes a distortion of the membranous appendages.

Pycnogonids will die in one-half per cent. chromic acid with the appendages fully extended.

Mollusca.—Lamellibranchs, Prosobranchs and, Heteropods should be narcotized in alcoholized sea-water. To avoid the closure

of the valves of Lamellibranchs on immersion in 70 per cent. alcohol, little plugs of wood should be placed between the margins of the valves. The same result may be effected in the case of Prosobranchs by tying the internal edge of the operculum to the shell.

Of the Opisthobranchs the æolidæ may be best preserved by pouring over them concentrated acetic acid in volumes equal to or double that of the sea-water containing them. Dorids should first be narcotized by gradually adding 70 per cent. alcohol to their sea-water, and then killed with concentrated acetic acid or boiling sublimate. The larger forms may be killed in 1 to 5 per cent. chromic acid.

Pteropods are preserved well in Pereny's Fluid for fifteen minutes, whence they are passed to 50 per cent. alcohol. Gymnosomatous forms should be first narcotized with 1 per cent. chloral hydrate, and then killed in acetic acid or sublimate.

Decapod Cephalopods may be fixed directly in 70 per cent. alcohol, making an opening on the ventral surface to allow the alcohol to reach the internal parts.

Bryozoa.—The genera *Pedicellina* and *Loxosoma* may be left for an hour in 1 per cent. chloral hydrate, and then killed with cold corrosive sublimate, washing them immediatety afterwards. Some species of *Bugula* give good results when the expanded animals are suddenly killed by pouring over them hot corrosive sublimate. With other forms it is sometimes possible to preserve them well expanded by adding 70 per cent. alcohol gradually to the surface of the water in which they are, or by narcotizing first in weak chloral hydrate or in alcoholized sea-water. The results are, however, uncertain, and depend largely on the skill of the preparator.

Brachiopoda may be treated in the same manner as Lamellibranchs.

Tunicates.—Clavellina, Perophora, and *Molgula* may be killed with the orifices expanded by immersing them in 1 per cent. chloral hydrate for 6 to 12 hours. They should then be killed in chrom-acetic mixture, No. 2, and quickly transferred to 1 per cent. chromic acid, injecting some of the fluid into the body. After half an hour they should be transferred in 35 per cent. alcohol, the injection being repeated, and finally to 70 per cent. Other simple forms may be treated in the same manner, or may require the 2 per cent. solution of chloral hydrate, or may be killed by pouring a little 1 per cent. chromic acid on the surface of the water in which they are, subsequently hardening in 1 per cent. chromic acid. The method recommended for *Perophora* may be employed for compound Ascidians, using, however, corrosive sublimate instead of the chrom-acetic mixture.

Salpæ vary considerably in consistency, according to the species, and different methods are consequently required. The denser forms, such as *S. zonaria,* should be placed in a mixture of 100 c.c. fresh water and 10 c.c. concentrated acetic acid, where they should remain for fifteen minutes. They should then be washed in fresh water for ten minutes, and pass gradually into alcohol. Less dense forms, such as *S. democratica mucronata,* may be fixed in chrom-acetic mixture, No. 1, and then passed directly into fresh alcohol; while the soft forms, such as *S. pinnata* and *maxima,* should be placed in chrom-osmic mixture for 15 to 60 minutes, then washed in fresh water, and transferred to weak alcohol.

Fishes.—Amphioxus will die with the buccal cirrhi distended in sea-water alcoholized to 10 per cent. They should then be transferred to 50 per cent. alcohol, and gradually to 70 per cent.

Other forms may be preserved in alcohol (70 per cent.), taking care to make a ventral incision, and also to inject the alcohol and renew it frequently at first. If it is wished to preserve some of the larger Selachians for some months in order to prepare at leisure the skeleton, the intestines should be removed, and the animals placed in a 10 per cent. solution of salt.

Elasmobranch embryos may be fixed in corrosive sublimate, leaving them in the solution for 5 to 15 minutes, afterwards washing well in iodized alcohol. Embryos of *Torpedo* with the yolk were preserved by immersing them in a mixture of equal parts of 1 per cent. chromic acid and corrosive sublimate for fifteen minutes, and then transferring to alcohol.

Transparent fish eggs may be preserved for the purpose of demonstration by subjecting them for a few minutes to the action of the alcohol and hydrochloric acid mixture, and then transferring them to pure alcohol.—PLAYFAIR M'MURRICH.

ENTOMOLOGY.[1]

The Long-legged Harvest Spider.—In my Descriptive Catalogue of the Phalangiinæ of Illinois[2] I described, under the name *Liobunum nigropalpi* Wood, a harvest spider that occurred rather commonly in southern Illinois, and which, from the extreme length of its legs and other characters, had been identified as the species indicated. I have lately received, however, through the kindness of Professor George F. Atkinson, specimens of a harvest spider taken in North Carolina which proves to be Wood's species, leaving the Illinois species without a name. On account of its exceedingly long legs the specific name *longipes* is proposed for it, in connection with the description given below. We have taken both sexes a number of times this season in central Ohio; and Professor Atkinson has sent a single specimen taken at Auburn, Alabama.

Liobunum longipes n. sp. Plate.—Figs. 1 and 2.—Male.—Body 4 mm. long; 3 mm. wide. Palpi 4 mm. long. Legs: I., 49 mm.; II., 99 mm.; III., 50 mm.; IV., 67 mm.

Dorsum minutely tuberculate, reddish-brown with a subobsolete dark central marking, sometimes simply represented by obscure dark blotches. Eye eminence at least as broad as high, black above, canaliculate, with small black tubercles on the carinæ. Mandibles light yellowish-brown, tips of claws black; second joint with sparse hairs. Palpi slender, light brown, distal portion of femur, and almost all of patella, black; femur, patella, and tibia with small scattered tubercles, and short hairs; tarsus, with a row of subobsolete, small, black tubercles on its inner ventro-lateral surface. Ventrum paler than dorsum, of a nearly uniform tint. Coxæ minutely tuberculate, of same color as ventrum. Trochanters black. Legs very long, slender, black with white annulations at distal extremities of femur and tibia, especially in the second and fourth pairs. Shaft of genital organ flattened, contracted near its distal extremity, and bent upwards, terminating in an acute point.

Described from many specimens.

The body of the female is slightly larger than the male, with the central marking usually more pronounced.

The accompanying plate is engraved from drawings by Miss Freda Detmers. Fig. 1 represents the male, natural size, while Fig. 2 shows

[1] Edited by Dr. C. M. Weed, Ohio Agricultural Experiment Station, Columbus, Ohio.

[2] Bull. Ill. St. Lab. Nat. Hist., Vol. III., Art. V.

PLATE XXIX.

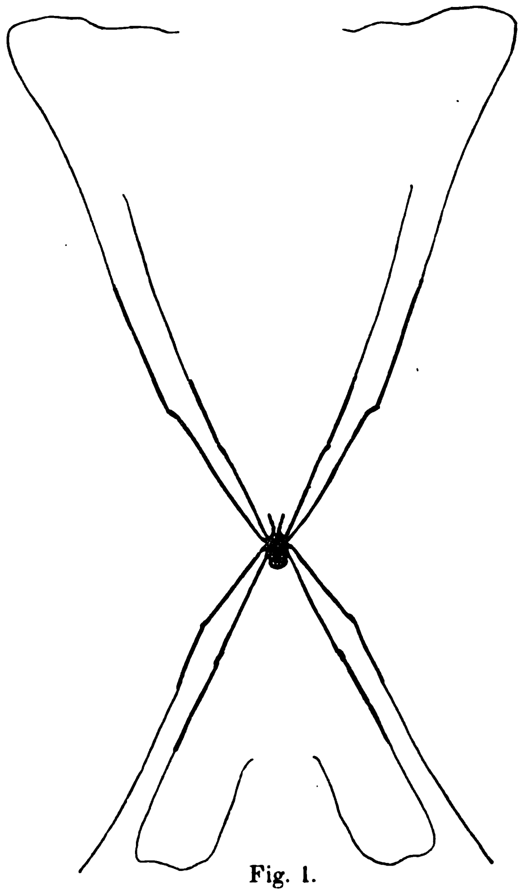
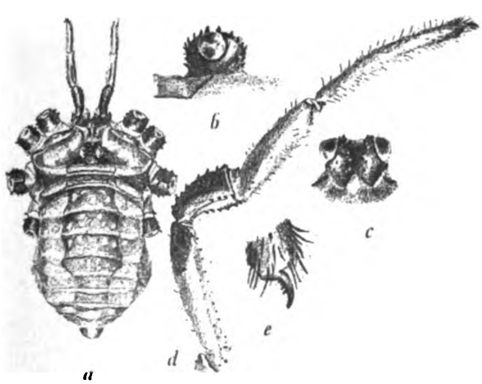


Fig. 1.



Liobunum longipes Weed.

details of the same, magnified : *a* being a back view of the body ; *b*, a side view of the eye eminence ; *c*, a front view of the same ; *d*, the palpus, side view ; and *e*, the palpal claw, side view.—CLARENCE M. WEED.

Food-Plants of the Clover-Stem Borer.[1]— Until very recently the accepted life-history of the clover-stem borer (*Languria mozardii*) rested upon the observations recorded by Professor J. H. Comstock in the Report of the U. S. Department of Agriculture for 1879. Briefly stated, these observations showed that the eggs of the insect are deposited during June in the stems of red clover ; that the larvæ hatching shortly after feed upon the pith of the stalk, pupate within the burrow the same season, and emerge as beetles during August, September, and October, hibernating as adults. As to remedies, Professor Comstock says :

"It seems probable that where clover is regularly cut in early summer, and again in fall, this insect will not increase to any alarming extent ; but where this is neglected, or where there is much waste clover, it may do considerable damage."

Essentially these facts and recommendations have been rehearsed by a number of writers during the last decade ; but in a recent article in *Insect Life* (Vol. II., pp. 346–7), Mr. F. H. Chittenden has shown that this species develops in horse-weed (*Ambrosia trifida*), and probably also in nettle (*Urtica dioica*), daisy fleabane (*Erigeron ramosus*), and ox-eye daisy (*Chrysanthemum leucanthemum*). Mr. F. M. Webster has also found a larva indistinguishable from that of the present species in stems of timothy (*Phleum pratense*).

My observations upon this species began the present summer, and show that the insect has even a greater range of food-plants than these facts would indicate. Between July 12 and August 12, larvæ, pupæ, or adults of *L. mozardii* were found in the stems of the following plants : Yarrow (*Achillea millefolium*), sweet clover (*Melilotus alba*), wild lettuce (*Luctuca canadense* and *L. floridanum*), bellflower (*Campanula americana*), thistle (*Cnicus altissimus*), fleabane (*Erigeron philadelphicus*), and nettle (*Urtica gracilis*).

A large number of stems of red clover were examined for the insect, but none were found. Hence it seems probable that the species prefers uncultivated plants, especially the compositæ, for breeding purposes.—CLARENCE M. WEED.

[1] Read before Entomological Club, A. A. A. S., August, 1890.

Outlook for Economic Entomology.—An interesting article upon this subject, by Dr. C. V. Riley, is published in the *American Garden* for July, 1890. The author says: "All late advances in the study, and all probable advances in the immediate future, come under three chief categories: (1) The ascertaining of every detail in the life-history of species at present injurious, or likely to become injurious. (2) Thorough and careful experiments with insecticide substances. (3) The invention and improvement of apparatus for the application of insecticides. . . . As one of the immediate results of the great increase in the number of paid entomologists who are able to devote all or nearly all of their time to the work, consequent on the recent establishment of the State Experiment Stations, we may expect, after a little preliminary repetition of previously known facts and remedies in the interest of accessibility, great advance along the lines of our first category. Our knowledge of the life-histories and habits of all plant-destroying pests should take great and immediate strides, and, as I have shown, new preventives and remedies will undoubtedly result from the establishing of facts of this character. Progress in the second and third categories will be much slower. Yet we may confidently anticipate advances in the cheapening of insecticides, and in better knowledge of their properties and the conditions governing their application. We may as confidently look for cheaper and better apparatus, though radical and important discoveries in this direction are hardly to be anticipated, however much hoped for."

Recent Literature.—One of the most useful volumes ever published by the Department of Agriculture has lately been issued by the Bureau of Animal Industry. It is by Dr. Cooper Curtice, and is entitled, "The Animal Parasites of Sheep." There are 221 pages and thirty-six plates, the latter being well-executed lithographs from drawings by Haines and Marx. As Dr. Salmon well remarked in his letter of transmittal: "The subject of parasites and parasitic diseases is one of great importance, and must become more prominent as the number of domesticated animals in the country increases, and the pastures become more limited in comparison with the flocks which graze upon them. Under such conditions parasites multiply more rapidly, and their ravages become more alarming. For this reason the time has come when we must pay more attention to these organisms, and study more assiduously the means of controlling them, if we would preserve that healthfulness and vigor for which the animals of this country have heretofore been noted."

The first issue of the *Agricultural Gazette* of New South Wales, a government bulletin, contains two articles by the official entomologist, Mr. A. S. Olliff; in one the Codlin Moth is discussed, while the other treats of the Corn Worm or Boll Worm (*Heliothis armigera*), which is there called the Maize Moth. Mr. Olliff also calls attention to an injury to pumpkin vines by a plant-eating lady-bird (*Epilachna vigintiocto-punctata*), an insect of the same genus as our *E. borealis*, which feeds on cucumber plants.

Bulletin No. 22 of the United States Division of Entomology consists of reports from Messrs. Coquillet, Osborn, Webster, Kœbele, Bruner, and Miss Murtfeldt, of observations and experiments in the practical work of the division. Professor Osborn's discussion of the Hemiptera injuring grasses is of special interest.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

American Association for the Advancement of Science, Indianapolis.—The officers of the meeting were: *President*, George Lincoln Goodale, of Cambridge, Mass. *Vice-Presidents: A.*—Mathematics and Astronomy—S. C. Chandler, of Cambridge, Mass.; *B.*—Physics—Cleveland Abbe, of Washington; *C.*—Chemistry—R. B. Warder, of Washington; *D.*—Mechanical Science and Engineering—James E. Denton, of Hoboken, N. J.; *E.*—Geology and Geography—John C. Branner, of Little Rock, Ark.; *F.*—Biology—C. S. Minot, of Boston, Mass.; *H.*—Anthropology—Frank Baker, of Washington; *I.*—Economic Science and Statistics—J. Richards Dodge, of Washington. *Permanent Secretary*, F. W. Putnam, of Cambridge (office Salem, Mass.). *General Secretary*, H. Carrington Bolton, of New York. *Secretary of the Council*, Harvey W. Wiley, of Washington, D. C. *Secretaries of the Sections: A.*—Mathematics and Astronomy—Wooster W. Beman, of Ann Arbor, Mich.; *B.*—Physics—(Vacancy to be filled by election in Section); *C.*—Chemistry—W. A. Noyes, of Terre Haute, Ind.; *D.*—Mechanical Science and Engineering—(Vacancy to be filled by election in Section); *E.*—Geology and Geography—Samuel Calvin, of Iowa City, Iowa; *F.*—Biology—John M. Coulter, of Crawfordsville, Ind.; *H.*—Anthropology—Joseph Jastrow, of Madison, Wis.; *I.*—Economic Science and Statistics—B. S. Fernow, Washington, D. C. *Treasurer*, William Lilly, of Mauch Chunk, Pa.

Thursday, August 21st.—Papers read in *Section E.—Geology and Geography.*—Preservation of Glaciated Rocks, by Homer T. Fuller. An Old Channel of the Niagara River, by J. T. Scovell. Niagara: A Few Last Words in Reply to Mr. G. K. Gilbert's History of the Niagara River, by George W. Holley. A Local Deposit of Glacial Gravel Found in Park County, Ind., by John T. Campbell. Concerning Some Portions of *Castoroides ohioensis* Foster, not heretofore known, by Joseph Moore. The "Barking Sands" of the Hawaiian Islands, by H. Carrington Bolton. Occurrences of Sonorous Sand on the Pacific Coast of the United States, by Carrington Bolton. Floridite, a New Variety of Phosphorite found in Florida, by E. T. Cox. The Columbia Formation in the Mississippi Embayment, by W. J. McGee.

Section F.—Biology.—Forest Trees of Indiana, by Stanley Coulter. Food of Bees, by A. J. Cook. A Case of Morbid Affection of the Eye in a Cat, by C. L. Herrick. Preliminary Notes on a New and Destructive Oat Disease, by B. T. Galloway. Observations on the Variability of Disease Germs, by Theobald Smith. Changes in the Ciliated Areas of the Alimentary Canal of the Amphibia During Development, and the Relation to the Mode of Respiration, by Simon H. Gage and Susanna P. Gage. Combined Aerial and Aquatic Respiration in Amphibia, and the Functions of the External Gills in Forms Hatched on Land, Simon Gage. The Trimorphism of *Uromyces trifolii*, J. K. Howell, presented by W. R. Dudley. The Harvest Spiders of North America, by Clarence M. Weed. Morphology of the Blood Borpuscles, by C. S. Minot. Observations on the Life-History of *Uncinula spiralis*, by B. T. Galloway. On the Seed Coats of the Genus Euphorbia, by L. H. Pammel. Observations on the Method of Growth of the Prothallia of the Filicineæ, with Reference to their Relationship, by Douglas H. Campbell. Development of the Sporocarp of *Griffithsia bornetiana*, by V. M. Spalding. Contributions to the Life-History of Isæus, by Douglas H. Campbell.

Section H.—Anthropology.—Indian Origin of Maple Sugar, by H. W. Henshaw. Fort Ancient, by W. K. Moorehead. Aboriginal Stone Implements of the Potomac Valley, by W. H. Holmes. Suggestion for a Pan-American as Precursor to an Universal Language, by R. T. Colburn. Dialectic Studies in the Swedish Province of Dalecarlia, by J. Muller. Notice of a Singular Earth-work near Fosters, Little Miami Valley, Ohio, by F. W. Putnam.

Papers read on Friday, August 22d, in *Section E.—Geology and Geography.*—What Constitutes the Taconic Mountains? N. H. Winchell. The Formations and Artesian Wells of Memphis, Tenn.,

James M. Safford. Progress in Morainic Mapping, T. C. Chamberlain. Remarks on Construction of Topographic Maps for Geologic Reports, Arthur Winslow. Notes on the Occurrence of Pegmatite in Central Missouri, Arthur Winslow. The Amount of Natural Gas Used in Glass Manufacture, Edward Orton. Differentiation of Subterranean Water Supplies, J. E. Siebel. Some of the Qualifying Conditions of Successful Artesian Well-Boring in the Northwestern States. C. W. Hall. A Notable Dike in the Minnesota River, C. W. Hall. Topographical Features of Arkansas Marbles, T. C. Hopkins. The Origin of the Manganese Ores of Northern Arkansas and its Effect on the Associated Strata, R. A. F. Penrose, Jr. The Novaculites of Arkansas, L. S. Griswold. Subsidence and Deposition as Cause and Effect, E. W. Claypole.

Section F.—Biology.—The seven following papers were assigned at the Toronto meeting, under the general head of "Geographical Distribution of North American Plants:" The Relation of the Mexican Flora to that of the United States, Sereno Watson. The Distribution of the North American Umbelliferæ, John M. Coulter. The Distribution of Hepaticæ of North America, Lucien M. Underwood. The Migration of Weeds, Byron D. Halsted. Geographical Distribution of North American Grasses, W. J. Beal. Geographical Distribution of North American Cornaceæ, John M. Coulter. The General Distribution of North American Plants, N. L. Britton. On the Plates of *Holonema rugosa*, H. E. Williams. On the Structure of Certain Palæozoic Fishes, E. D. Cope. External Termination of the Uretha in the Female of *Geomys bursarius*, Herbert Osborn. Work of the Botanical Division of the Department of Agriculture, F. V. Coville. On the Lack of the Distance Sense in the Prairie Dog, Burt G. Wilder. Disappearance of the *Decidua reflexa*, C. S. Minot. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Potato Scab, a Bacterial Disease, H. L. Bolley.

Section H.—Anthropology.—Exhibition of Diagrams of the Brains and Medisected Heads of Man and a Chimpanzee, Burt G. Wilder. Peculiar Effects of One-sided Occupations on the Anatomy and Physiology of Man, J. Muller. Exhibition of a Bone Image from Livingston County, N. Y., C. C. Abbott. Exhibition of Gold Beads of Indian Manufacture from Florida and New Jersey, C. C. Abbott. Notice of a Singular Earth-work near Fosters, Little Miami Valley, Ohio, F. W. Putnam. A Study in Mental Statistics, J. Jastrow. Arts of Modern Savages for Interpreting Archæology, O. T. Mason.

Papers read on Monday, August 24th, in *Section E.—Geology and Geography.*—Subsidence and Deposition as Cause and Effect, E. W. Claypole. On the Paleontological and Geological Relation of Closely Similar Fossil Forms, C. A. White. The Crystalline Rocks of Central Texas, Theo. B. Comstock. The Geology of the Wichita Mountains, Indian Territory, Theo. B. Comstock. The Silurian System and Its Geanticline in Central Texas and Indian Territory, Theo. B. Comstock. Topographical Evidence of a Great and Sudden Diminution of the Water Supply in the Ancient Wabash, John T. Campbell. Glacial Action Considered as a Continuous Phenomenon, Having Shifted from One Locality to Another, P. H. Van der Weyde. Geology of Indian Territory South of Canadian River, R. T. Hill and James S. Stone. The Recent Explosion of Natural Gas in Shelby County, Ind., H. E. Pickett and E. W. Claypole. Note on the Stony Meteorite that Recently Fell in Washington County, Kan., E. H. S. Bailey. The Bendigo (Brazil) Meteorite, Orville A. Derby. A New Method of Searching for Rare Elements in Rocks, Orville A. Derby. Observations on the Genesis of Certain Magnetites, Orville A. Derby. Nepheline-Bearing Rocks in Brazil, Orville A. Derby.

Section F.—Biology.—The Development and Function of the So-called Cypress "Knees," with a Consideration of the Natural Habitat of the Tree, W. P. Wilson. Potato Scab, a Bacterial Disease, H. L. Bolley. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Preliminary Note on the Genus Rhynchospora in North America, N. L. Britton. On Rusbya, a New Genus of Vacciniaceæ from Bolivia, N. L. Britton. The Distribution of Land Birds in the Philippine Islands, J. B. Steere. Exhibition of Diagrams Illustrating the Formation of the Human Sylvian Fissure, Burt G. Wilder. Structure of the Stomach of *Amia calva*, G. S. Hopkins. Differentiation of the Primitive Segments in Vertebrates, C. S. Minot. A Support for the Chorda Tympani Nerve in Felidæ, T. B. Spence. Notes on the Amphibia of Ithaca, Simon H. Gage and H. W. Norris.

Section H.—Anthropology.—The Form of the External Ear, H. D. Garrison. Preliminary Steps to an Archæological Map of Franklin County, Ind., H. M. Stoops. The Relation of Mind to its Physical Basis, E. D. Cope. Remarks Upon the Mounds of Sullivan County, Ind., J. W. Spencer. On the Atbatl or Spear-Thrower of Ancient Mexico, Zelia Nuttall. On an Ancient Hearth in the Little Miami Valley, F. W. Putnam. The Evolution of a Sect, Anita Newcomb McGee. On Obsidian Implements of California, H. N. Rust. The

Basket-Mortar of Southern California, H. N. Rust. The Adze, H. N. Rust.

Papers read on Tuesday, Aug. 25th.—*Section F.—Biology.*—Account of the Marine Biological Laboratory at Wood's Holl, Ç. S. Minot. The Desirability of Establishing a Biological Station on the Gulf of Mexico, W. P. Wilson. Potato Scab, a Bacterial Disease, H. L. Bolley. The Continuity of Protoplasm Through the Cell-Walls of Plants, W. J. Beal and T. W. Tuomey. Preliminary Note on the Genus Rhynchospora in North America, N. L. Britton. On Rusbya, a New Genus of Vacciniaceæ from Bolivia, N. L. Britton. Notes on a Monograph of the Genus Lechea, N. L. Britton.

The general session of the A. A. A. S. transacted a large amount of business, and the next meeting, to be held in the city of Washington, in August, 1891, will open with a clear page. It was voted that names of candidates for fellowship must be presented before the first meeting of the council in each year. A resolution was passed instructing the committee on forestry to bring the matter of preserving the groves of Sequoia trees of California to the special attention of Congress and the Secretary of the Interior.

A resolution was passed recognizing the services to science of Senors Barao de Guahy and Jose Carlos de Carvalho, citizens of Brazil, who by the expenditure of many thousands of dollars by the first, and many months of gratuitous labor on the part of the latter, caused to be transported from its original position in the interior of the State of Bahia to the National Museum in the city of the Rio de Janeiro the famous Bendigo meteorite, the largest mass of sidereal matter ever placed in any museum. This meteorite is said to weigh about five tons.

The committee on reduction of tariff on scientific books reported progress, and an item providing for the free transportation of scientific books by individuals has been introduced into the McKinley bill. As this item embraces only books in languages other than English, representations have been made by the committee to members of the Ways and Means Committee of the Senate which, it is hoped, will result in the inclusion of scientific books printed by the English government and scientific societies.

It was resolved that the A. A. A. S. request of the Secretary of the Navy the careful consideration of the memorial recently presented by various observatories relative to furnishing of time signals to the Western Union Telegraph Company by the naval observatory for commercial purposes. It was also resolved that the association joins the observatories of the United States and Canada in asking the Secretary

of the Navy to consider the system which has been established at the naval observatory, in pursuance of which time signals are given for commercial purposes to the Western Union, and to cause this practice to be so changed as not to injure the work of the local observers.

Mr. Amos W. Butler moved that the permanent secretary be empowered to extend invitations to the governments of Mexico, Central and South America to send delegates from the different scientific societies of those countries to the meeting of the association at Washington. The resolution was adopted, after which Permanent Secretary Putnam announced that of the 364 members and associates in attendance upon the present meeting, Indianapolis furnished 27; Indiana, outside of Indianapolis, 64; Ohio, 38; New York, 29; District of Columbia, 30; Illinois, 26; Michigan, 22; Massachusetts, 19; Kentucky, 14; Iowa, 12; Pennsylvania, 12; Missouri, 12; New Jersey, 6; Nebraska, 6; Wisconsin, 5; Tennessee, 4; Arkansas, 2; Maine, 2; Canada, 6. There were also representatives from Rhode Island, West Virginia, England, Scotland, New Hampshire, Arizona, Texas, and other States.

The resolutions of thanks comprehended nearly all the railroad companies that enter that city, the street-railroad company, the people of Indianapolis, Noblesville, Kokomo, Marion, Muncie, Anderson, Terra Haute, and New Albany, the local committee, the ladies of that committee, and the press. The various corporations, committees, and persons thus thanked were not disposed of in one resolution, but taken up seriatim and each brought, as in toast-making, for a little speech from the proposer, and one from the gentleman designated to respond. In this way speeches were made by Mr. F. E. Nipher, of St. Louis; Prof. E. T. Cox, of New York; Prof. E. D. Cope, of Philadelphia; Secretary Putnam, of Cambridge, Mass.; Mr. A. W. Butler, of Brookville; Mr. A. F. Potts, of Indianapolis; Professor Avery, of Cleveland; Professor Abbe, of Washington, D. C.; President-elect Prescott, of Ann Arbor; Professor Mees, of Terre Haute; Dr. Hover, of New York; Professor Mason, of Washington, D. C.; Mr. G. W. Holley, of Ithaca, N. Y.; Prof. Stanley Coulter, of Lafayette; Prof. Charles R. Barnes, of Madison, Wis.; and ex-President Mendenhall, of Washington, D. C. After this the meeting adjourned.

On Saturday, August 23d, an extensive trip was arranged to cover the immense gas territory of Indiana.

A special train was provided, which left the city in the morning, going north over the Lake Erie & Western R. R., through Noblesville to Kokomo, where the gas field was explored, and a visit made to

the largest plate glass factory in the United States, and other establishments where natural gas is applied to manufacturing uses.

From Kokomo the party was taken to Marion, from there to Muncie, and from Muncie to Anderson, where a magnificent display of gas at night was given, embracing a beautiful and fantastic feature, by the introduction of a gas-main under the White River. From Anderson the party returned to Indianapolis, arriving at midnight.

On Monday afternoon a special train took the botanists to South Waveland, where carriages were provided to take them to the "Shades of Death." A lunch was served before returning.

The Science Club, of Terre Haute, invited Sections B, C, and D to hold their session at the Rose Polytechnic Institute, Terre Haute, on Friday, August 22d, which invitation was accepted. A lunch was served by the citizens of Terre Haute.

The citizens of Lafayette extended an invitation to Section F to visit Lafayette, but the Section thought it impracticable to accept.

A special excursion was secured from Indianapolis to the Mammoth Cave of Kentucky, Wednesday, August 27th.

SCIENTIFIC NEWS.

The Delaware Valley Ornithological Club.—Recognizing the advantages to be gained by combined work, a number of ornithologists residing in the vicinity of Philadelphia have organized the Delaware Valley Ornithological Club, for the study of the birds of southeastern Pennsylvania and southern New Jersey, with especial reference to their migration in the valley of the Delaware River. The active membership of the club is limited, and consists only of those who have had considerable experience in field work, and are known to be thoroughly reliable. An associate membership has been added to include beginners in the study who can furnish data subject to the approval of the active members, and in return can receive the benefit of their experience.

The following is a brief outline of the methods of work of the club: Daily field notes are taken by the members, and recorded systematically on monthly charts containing vertical columns for the days and horizontal ones for the birds in the order of their occurrence during the month. The spaces are sufficiently large for recording the number of birds seen (as recommended by Mr. Batchelder, in the April number of *The Auk*), and short abbreviated notes as to singing,

mating, nesting, etc. Across the top of the chart are blanks for recording the curve of temperature variation, the direction and force of the wind, and other corellative notes. In addition to these individual charts there are "combined monthly charts," on which the notes of all the observers are recorded, followed by private marks indicating their various stations. These charts are passed from one member to another, and when all the data have been recorded are reproduced by a copying process and copies furnished to each observer. In the same way it is proposed to have yearly charts on which will be recorded the first and last occurrence, arrival and departure of bulk, and other general facts relating to each species.

The club meets in Philadelphia twice a month, when all matters of importance are discussed and specimens exhibited.

Another aim of the club is to keep a complete record of all the birds which occur in southeastern Pennsylvania and southern New Jersey, and of the breeding habits of those species which remain in this district during the summer. These observations will cover a wider field than those on migration, the latter being confined to the immediate vicinity of the Delaware River south of Trenton, as it is thought that better results can be obtained by restricting the country covered by the observations to one river rather than by including other river or coast districts.

During the present year the club has seven regular observers,—Wm. L. Baily at Wynnewood, Pa.; Samuel N. Rhoades at Haddonfield, N. J.; J. Harris Reed at Tinicum Island, Pa.; Geo. Morris at Olney, Pa.; Dr. Spencer Trotter at Swarthmore, Pa.; Chas. A. Voelker at Chester, Pa., and Witmer Stone at Germantown, Pa.

The results so far have been highly satisfactory, and have far surpassed our expectations. We therefore thought by stating our methods of work other observers similarly situated might be led to "join their forces" and gain the benefit of each other's work as we have done.

This work need not interfere in any way with that being conducted by the Department of Agriculture, as the correspondents of the Department can fill out their schedules as heretofore, or they can substitute the combined report of the club, as may be desired. In any case the results obtained by the combined efforts of a number of observers in a small district cannot fail to be of service to the Department when it undertakes to work out the migration through the country at large.

At the close of the year we hope to present to *The Auk* an abstract of the migration of 1890 as it occurred in the valley of the Delaware, with a map showing the district covered by each observer.—WITMER STONE *in The Auk*.

THE

AMERICAN NATURALIST

VOL. XXIV. OCTOBER, 1890. 286.

THE MESODERM AND THE CŒLOM OF VERTEBRATES.

BY CHARLES-SEDGWICK MINOT.

THE morphology of the mesoderm is one of the most vexed questions of the day. Scarcely an embryologist can be found who has not published opinions on this question considerably at variance with those of most others. It has been maintained that the mesoderm arises from the ectoderm; that it arises from the the entoderm, or from both; from neither, but from two special segmentation spheres; that it has a double origin, part coming from the blastoderm, part from the yolk; and even that there is no mesoderm.

We now know positively that in all vertebrates there is a distinct and unmistakable mesoderm, which spreads out from the primitive streak in all directions, and has distinctive histological characteristics. Two large cavities appear in this mesoderm on either side of the median axial line. The mesodermic cells which bound these two cavities assume an epithelial arrangement, and are designated as the *mesothelium;* the cavities constitute the *cœlom;* the remainder of the mesoderm is known as the *mesenchyma*, and corresponds to the embryonic connective tissue of older writers. The mesothelium at various points throws off cells, which are added to the mesenchyma. We have accordingly two distinct phases to study, viz., the origin of the mesoderm, and the differentiation of the mesenchyma and mesothelium, and together with the latter the formation of the cœlomatic cavities.

I. ORIGIN OF THE MESODERM.

Mesoderm of Elasmobranchs.—In the cartilaginous fishes the mesoderm arises from the entoderm close to the ectental line. The observations of Balfour in his monograph, *2* (see also his works, I., 246–268), established the fact that the mesoderm appears after the two primary layers and is connected with the entoderm. This fact has since been abundantly confirmed (see Kollmann, *25;* Swaen, *41;* Rückert, *32, 33;* Rabl, *29;* D. Schwarz, *36*, et al). These later observations, particularly those of Rückert and Rabl, have settled the exact point, or rather area, of entoderm which is mesoblastogenic. Unfortunately Rabl overlooked the phenomena of concrescence, and consequently reached conclusions as to the development of the mesoderm which I feel no hesitation in pronouncing erroneous. The mesoderm is differentiated along the embryonic rim before concrescence takes place; hence, when concrescence is partly completed, there is an axial stretch of mesoderm, and from the hind end of this the mesoderm spreads out toward each side along the embryonic rim in connection with the entoderm, as has been described.[1] We can distinguish the axial mesoderm from the lateral mesoderm; but later on, when concrescence has progressed further, there is no lateral mesoderm, for it has become axial. Rabl, however, failed to study the later stages, and so came to consider that this temporary condition of the mesoderm signified a double origin; accordingly he distinguishes between the "gastral" (axial) and "peristomal" (lateral) mesoderm, and makes the unsuccessful attempt to show that the "gastral" and "peristomal" mesoderms are of essentially different origin in all vertebrates. Had Rabl accepted the law of concrescence, he would certainly have not fallen into these errors. There is no evidence whatever that there is an evagination of the entoderm, as the Hertwigs maintain can be shown in the amphibians (see below). On the contrary, the cells grow forth from the entoderm, so as to constitute a sheet between the primary germ-layers. Soon the connection with the entoderm is permanently severed.

[1] AMERICAN NATURALIST, 1890, p. 507.

The fact that the mesoderm appears first in the embryonic rim renders it easy to make sure of its springing from the entoderm. Later, when concrescence moves the rim into the axial line, all three germ-layers are united in the axis of the primitive streak, and it becomes more difficult to decide which of the layers the mesoderm is specially connected with. To conclude: In Elasmobranchs the mesoderm arises over a limited area of the entoderm near the ectental line; it separates from the entoderm apparently by a process of delamination, but the exact means of separation have yet to be investigated; it remains for a while connected with the entoderm along the embryonic axis; after its separation from the entoderm the mesoderm expands by proliferation of its own cells, and receives no accretions from the yolk, so far as at present known.

Mesoderm of Teleosts.—So far as the published accounts go the middle layer of bony fishes arises, as maintained by Balfour (*Comp. Embryol.*, II., 74), from the entoderm. Such appears to be the significance of Ryder's observation, *34*, 41, of A. Goette's, *9*, E. Ziegler's, *45*, Agassiz and Whitman's, *1*, and of others. For a good description, together with citations of conflicting authorities, see M. Kowalewski, *26*, 469–474. Apparently the blastodermic rim is turned under, and the turned-under portion yields the entoderm, and is intimately connected with the sheet of mesodermal cells, very much as in sharks; the mesoderm is several layers thick, and extends under the ectodermal blastoderm, gradually thinning out; the cells of the middle layer are at first closely compacted.

Mesoderm of Amphibia.—Here it seems also clearly established that the mesoderm arises from the entoderm, principally along and alongside the median line, as a sheet of cells with no cavity (cœlom) included between them; along the axis of the primitive streak and at the blastoporic margin the connection between the mesoderm and the entoderm is both evident and intimate (see Bellonci, *5*, Tav. II., for figures showing this point in the axolotl, and O. Schultze, *35*, for similar figures of *Rana fusca*). These facts have been recorded by so many observers that there can be little doubt or none of their entire accuracy (see the description

and cuts, *ante* p. 618). It may be considered as still uncertain whether the sheet of mesoderm receives accretions at its distal edge from the yolk cells (entodermic) upon which it rests. There usually is no sharp limit between the two, and therefore we must consider it probable that at first the mesoderm receives additions from the yolk; later on it is found divided from the vitelline cells, and after it has split off it probably grows independently. The growth of the mesoderm at first from the yolk has been found in Petromyzon by A. E. Shipley, *38*, 177–178 (of Studies), although in later stages the mesoderm is severed from the yolk.

In later stages the mesoderm is wanting in the median line, and thus constitutes two masses or two lateral sheets. This bilateral division is effected by the development of the medullary groove and notochord. The mesodermic connection with the entoderm is retained, but is double, owing to the division. Along the median dorsal line of the archenteron runs the strip of entoderm which forms the notochord; on each side of this strip runs the line of connection between entoderm and mesoderm. The study of this *secondary* condition has led many authors into the error of ascribing a double origin to the amphibian mesoderm, and inferentially to the vertebrate mesoderm in general. This brings us to the consideration of O. Hertwig's views, which form one of the chief supports of the "Cœlomtheorie" of the brothers Hertwig. For further discussion of this theory, see p. 893.

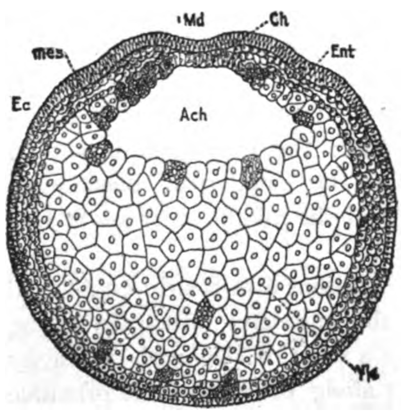


FIG. 23.—Axolote embryo: transverse section of an early stage; after Belonci. *Ec*, ectoderm, *mes*, mesoderm; *Md*, medullary groove; *Ch*, notochord; *Ent*, entoderm; *Ach*, archenteron; *Yk*, yolk.

O. Hertwig, *12*, *13*, studied stages in which the notochord had appeared, and at this time, as O. Schultze, *35*, has shown, the primitive relations of the layers no longer exist, but Hertwig regarded the secondary arrangements in question as primary. He found no meso-

derm in the axial line above the notochord; at the edge of the notochord, where it joins the undifferentiated epithelial entoderm of the archenteron, there is on each side a groove which in cross sections appears as a notch (Fig. 23); the notch is of variable depth, is sometimes absent, and is a temporary feature. In the neighborhood of the furrow, alongside the notochord, the mesoderm is still intimately connected with the entoderm. These relations are believed by Hertwig to indicate that the mesoderm arises as two masses, which is not the case, and that each mass is really a diverticulum of the archenteron, the furrow being the mouth of the diverticular cavity. Hertwig's figures, *12*, Taf. XIII.–XIV., offer the plainest representations of the mesoderm in Triton as paired diverticula; but these figures [1] are evidently digramatic, and they must be termed inaccurate, I think, in the very respect which are essential to Hertwig's theory. This appears from the investigations of Götte, *10*, Bellonci, *5*, Bambeke, *3*, O. Schultze, *35*, and others; compare also K. Lampert, *27*. The reader may compare, for instance, Hertwig's Fig. 10, *l.c.* Taf. XIII., with Bellonci's Fig. 11, *l.c.* Tav. III. O. Schultze's detailed criticism, *l.c.* 344–349, of Hertwig's account seems to me entirely justified, and I accordingly accept it as a complete disproof. This criticism shows that Hertwig's conception is based upon insufficient and erroneous observations; insufficient because he did not investigate the early condition of the mesoderm, and failed to recognize the fugitive and unessential character of parachordal grooves; erroneous because the cavity in the mesoderm does not really communicate with that of the archenteron. There are other errors, which Schultze points out, and which are important.

We find in amphibia, at a certain stage, the axial (Rabl's gastrales) and lateral (Rabl's peristomales) mesoderm. The former is in the region of the completed concrescence, the latter around the edge of the anus of Rusconi. The former is connected with the entoderm alone; the latter with the ectoderm also, since the entoderm is connected with the ectoderm around the uncon-

[1] Some of them are reproduced in Hertwig's Lehrbuch der Entwickelungsgeschichte, sechstes Capitel.

cresced blastoporic rim. The connection with the ectoderm renders it possible that the middle layer receives cells from the outer layer, but there is no direct proof of this. When the concrescence is completed the mesoderm severs in the posterior axial region its connection with the entoderm, but retains awhile its connection with the outer germ-layer. The same phenomenon recurs in the amniota. It cannot, however, be taken to signify that the middle layer originates from the ectoderm, since at an earlier stage it is clearly entodermal.

Mesoderm of Sauropsida.—We may consider reptiles and birds together, since the early history of the mesoderm is very similar in the three classes. In *birds*, the exclusively entodermic origin of the mesoderm is in my opinion conclusively demonstrated by the researches of Duval, *8*, 104–117; the entoderm gradually thickens by migrations of its cells over a considerable axial area; the upper stratum of this thickened area separates off as the mesoderm, except that in the axial line it retains its connection with the entoderm; when concrescence takes place, the three layers are of course united in the axial line, and hence, as shown by Duval, the mesoderm is connected with the ectoderm. Hence we have two axial regions: 1°, the region of concrescence, characterized by the union of the mesoderm with the ectoderm, and known as the primitive streak; a little later the connection between the mesoderm and entoderm is lost in the posterior part of the streak, but retained in the anterior part; 2°, in front of the streak the region of completed concrescence known as the head-process, in which the mesoderm is united with the entoderm only. The secondary stage is the one best known through the investigations of many embryologists. It forms the starting of Rabl's investigations, *29*, 129–140, who accordingly failed to recognize the true origin of the mesoderm, having mistaken a secondary for a primary condition. After the mesoderm is once separated from the entoderm, it apparently receives no further cells from it, except in the axial region; it is not improbable that along the primitive streak cells are also thrown off from the ectoderm and added to the mesoderm.

In *reptiles*, so far as our present unsatisfactory knowledge enables us to judge, the development is similar; that is to say,

the mesoderm arises by delamination from the entoderm, but remains connected with it along the axial line in front, *i.e.*, in the head-process it remains connected with the entoderm only, but along the primitive streak it becomes secondarily connected with the ectoderm. After its delamination the mesoderm expands independently of other germ-layers, except along the axis. That the relations are like those in birds has been shown clearly by Strahl, *39*, and also by Weldon, *43*, whose figure is reproduced (*ante* p. 714, Fig. 22, A). The intimate connection of the mesoderm with the entoderm at the blastodermic rim before concrescence is sufficiently established by Kollman, *23*, 403–406, though his conception that this part of the mesoderm is a separate structure, which he terms akroblast, renders it difficult to follow certain parts of his description. C. K. Hofmann may also be cited, though his account (Bronn's Thierreich, Reptilien, p. 1881) is of doubtful accuracy in several respects. L. Will, *44*, 1127, finds that in the Gecko the mesoderm is united with the entoderm in the head-process, but omits to describe its exact connection with the primitive streak; the stages showing the *origin* of the mesoderm he does not mention. The processes involved will undoubtedly be understood as soon as the concrescence of the axis has been worked out,—a fundamental question which as yet not a single investigator has heeded.

Mesoderm of Mammals.—In this class, according to the best recent investigations, the mesoderm appears to have a distinctly two-fold origin. According to Bonnet, *6*, 196, part of the mesoderm grows out from Hensen's knot, at a time when the knot is a thickening of the ectoderm, and has not yet acquired any connection with the inner layer; another portion is produced peripherally (Fig. 18 *ante* p. 705) by delamination from the inner layer; the two anlages grow toward one another, and unite into one continuous mesoderm, in which all trace of the primitive double origin is obliterated. Kölliker has recorded (Würzburger Festschrift) the outgrowth of the mesoderm from Hensen's knot in the rabbit, and his statement has been confirmed by Fr. Carius, *7*, 17. In later stages we find the relations of the layers similar to those in Sauropsida, there being a head-process with the mesoderm

connected axially with the inner layer, and a primitive streak in the front part of which the three layers are connected axially, and in the hinder part of which the middle layer is connected with the outer layer only. This stage is quite well known; cf., Heape, *11*, on the mole; Bonnet on the sheep, *6;* Kölliker on the rabbit (*Grundriss*); Selenka on the opossum, *37;* Lieberkühn, *28*, and others; especially the very careful descriptions of the rabbit's layers by C. Rabl, *29*.

Now, we do not yet understand the homologies of the mammalian blastodermic vesicle, hence we cannot explain the peculiar relations of the mesoderm to Hensen's knot, as the homology of the knot is unknown. However, since mammals are in all respects related to the Sauropsida, and especially since there is a close likeness between the subsequent stages of the two classes, it is probable that the origin of the mammalian mesoderm will be shown ultimately to be essentially the same as in reptiles. At present it seems to me impossible to offer any satisfactory interpretation of the observed double origin of the mammalian mesoderm.

The Vertebrate Type of Origin of the Mesoderm.—The preceding paragraphs show that in all classes of vertebrates the origin of the mesoderm is essentially the same, *except* in the mammals. The relations in the mammals we do not understand. In the non-mammalian vertebrates the mesoderm first appears as a thickening of the entoderm over a not inconsiderable area around the concrescing blastodermic rim, and it becomes separated from the entoderm by the gradual parting of the upper cells to form the true mesoderm from the lower cells or permanent entoderm; this delamination does not take place next the blastodermic rim (or after concrescence in the axial line), hence in the region of the primitive streak the three layers may be connected for a time; further in the prolongation of the axis in front of the streak the mesoderm does not separate from the entoderm, thus forming the head-process. It is important to note that the mesoderm arises over a considerable area during the same period; that its formation may be more or less advanced before concrescence of the rim; and that after concrescence it stretches across the axis of

the embryo between the ectoderm and entoderm, thus becoming a continuous sheet or layer. This fact, that the mesoderm is a single anlage, needs to be specially emphasized. So far as known to me, there is not a single vertebrate which has been shown to lack this stage; but on the contrary, its occurrence is established for all classes, and by so many observers, that we may well assert that there are few facts in embryology better established. Later on the mesoderm becomes divided in the axial line, and a too exclusive consideration of this secondary condition has led to several theories of the mesoderm, which would hardly have been brought forward had their authors not neglected to take into account the earlier condition of the middle layer. Some of these theories are discussed below.

After its delamination the mesoderm is a distinct layer, and grows independently, receiving no accretions from the other layers, except in the axial line, where it receives cells from the entoderm, and in the region of the primitive streak. The edge of the expanding sheet of mesoderm is free, as has been pointed out in the previous chapter, resting upon the yolk, but not fused with it. It is, therefore, it seems to me, impossible to admit that there is a peripheral ingrowth of tissues arising from the yolk, and entering the mesoderm to form the blood, etc. (compare below, *Theories of the Mesoderm*).

The origin of the mesoderm in Amphioxus and invertebrates differs in many respects from that in vertebrates, and no attempt to establish the homologies of the processes throughout the animal kingdom has been successful. I accordingly merely give a brief notice of the mesoderm of Amphioxus, adding a mention of the mesodermal bands of invertebrates.

The ovum of Amphioxus is discharged from the body and impregnated externally; it is about 0.105 mm. in diameter, and as it contains only a small amount of yolk undergoes a holoblastic segmentation, which results in a well-marked blastula stage (Fig. 24), followed by a gastrula stage. The gastrula elongates, the blastopore remaining open at the posterior extremity. Differentiations now take place, by which the ectoderm forms the axial anlage of the nervous system, and the entoderm pro-

duces the notochord and the mesoderm; the three processes going on simultaneously. The accompanying Fig. 24 represents a cross section of a larva with segments. The ectoderm, *Ec*, everywhere bounds the section; on the dorsal side a portion of the ectoderm has been separated off to form the medullary plate, *Md*, above which is a small cavity. The cavity, *In*, of the archenteron is irregular, but symmetrical in outline; the entoderm bounding it can be separated into four parts: 1°, the lower portion, which forms the permanent entoderm, *Ent;* 2°, the upper median portion, which becomes the notochord, *Ch*; 3°, 4°, two lateral portions, constituting the diverticula, *Ms;* each diverticulum is a separate pouch, and as the development progresses, there are formed a series of pairs of pouches, stretching on either side along the notochord; later the pouches separate altogether from the archenteron, each becoming a closed sack; the first pair of pouches, however, retain their connection for a considerable period with the archenteron, and have been described by older writers as glandular organs. The development of the pouches is, with the exception noted, most advanced anteriorly, and as we go tailwards the pouches are less and less advanced in development, until, as shown in Fig. 25, they merge into the general entoderm as a band of cells, *Mes;* the last of which is the "mesoblast," *Mb*, a large granular cell, quite distinct from the remaining cells of the band or pouches. The pouches are the primitive segments (Ursegmente, mesoblastic somites of Balfour). In Amphioxus, then, the mesoderm arises from the entoderm along two lines, and is divided into paired hollow segments before it is separated from the mesoderm. Some writers, especially the brothers Hertwig, think this process of development to be primitive, and that the vertebrate type is derived from it. In true ver-

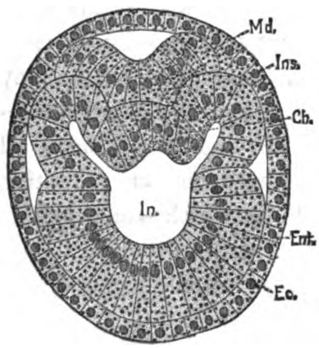


FIG. 24.—Transverse section of an Amphioxus embryo; after Hatschek. *Md*, medullary plate; *Ch*, notochord; *Ent*, entoderm; *Ec*, ectoderm; *In*, archenteric cavity; *Ms*, mesodermic segments.

tebrates the mesoderm arises on each side, but also in the axis, and becomes two masses, when the medullary groove and notochord appear. In Amphioxus the medullary plate and notochord appear very early, and the division of the mesoderm may be due to that fact. Amphioxus is undoubtedly a lower type, but whether it really preserves the older type of development in its purity is doubtful; indeed, it is probably a tunicate rather than a vertebrate.

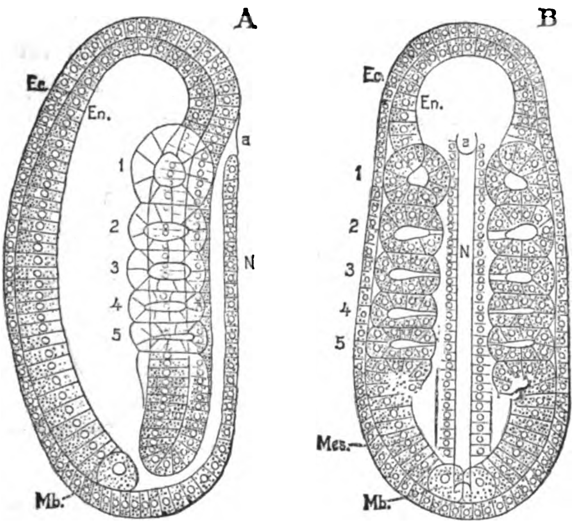


FIG. 25.—Amphioxus embryo; after Hatschek. A, side view; B, ventral view. *Ec*, ectoderm; *En*, entoderm; *a*, neuropore; *N*, nervous system; *Mes*, mesoderm; *Mb*, mesoblast; *1–5*, segments.

Hatschek, in a series of brilliant investigations, has shown that in many bilaterally symmetrical invertebrates the mesoderm arises as two bands of cells, which subsequently divide into a series of closed sacks (segments), and which, during their own formation, terminate each in a single large posterior cell (mesoblast), which throws off cells to add to the mesodermal band (germ-band, Keimstreif). This "mesoblast" by its appearance and position appears to be a derivative of the entoderm. As a matter of speculation, we may assume that in Amphioxus we have the germ-bands, but characterized by an exceedingly precocious segmentation. We can further assume that in vertebrates

we have the germ-bands also, but that they are modified, 1°, by the loss of the distinct terminal mesoblast; 2°, by precocious fusion in the axial line; and 3°, by extremely retarded segmentation. A great deal may undoubtedly be said in favor of these two assumptions, which together constitute the only "THEORY OF THE VERTEBRATE MESODERM" which of the many theories which have been advanced is at all likely, in my opinion, to prove of permanent value.

Expansion of the Mesoderm.—After the mesoderm is once formed as a distinct layer, without connection with the primitive layers except in the axial line, it expands independently,—that is, by the proliferation of its own cells. During its early expansion

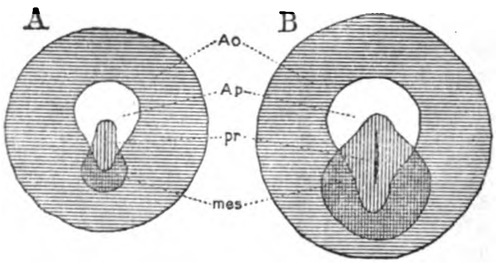


FIG. 26.—Diagrams of the embryonic area of the chick. *Ao*, area opaca; *Ap*, area pellucida; *pr*, primitive streak; *mes*, mesoderm. After Duval.

the mesoderm assumes in all amniota a definite series of characteristic outlines. It is at first pear-shaped (Fig. 26, A), the anterior end being pointed; it extends a short distance only in front of the primitive streak, and is widest a little distance behind the area pellucida, *Ap*. The same stage is found in mammals (see Kölliker, *Grundriss*, p. 93, and Fig. 71). The condition in the chick at about the twentieth hour of incubation is indicated by Fig. 26, B, drawn on the same scale as A, and at the close of the first day by Fig. 27. In the last-mentioned figure it will be noticed that the mesoderm is expanding unequally in front, having sent out two lateral wings, which leave a median space between them without mesoderm. These wings continue their growth, and finally meet in front, so that in the anterior part of the area pellucida there is a small tract without any mesoderm, although there is mesoderm all around it. This tract is the pro-

amnion, of which I shall give a fuller history elsewhere. The expansion does not take place by any means with the exact regularity indicated by Figs. 26 and 27, but, on the contrary, in birds, as shown by Zumstein, *46*, the outline of the middle layer is always irregular and more or less asymmetrical. Although there are not yet many observations available as to the outline of the growing mesoderm, yet it is probable that the preceding description is essentially correct, not merely for birds but for all amniota. It is certainly so for the rabbit (Van Beneden et Julin, *4*).

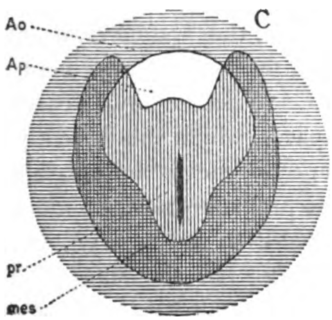


FIG. 27.—Diagram of the embryonic area of a chick. *Ao*, area opaca; *Ap*, area pellucida; *pr*, primitive streak; *mes*, mesoderm.

II. FORMATION OF THE CŒLOM.

Early in the course of development there appear in the mesoderm two large cavities, one on each side, which together constitute the *cœlom* or embryonic body cavity. In the adult mammal the cœlom is represented by the pericardial, pleural, and abdominal cavities; the cœlom also gives rise to the cavities of the muscular segments (protovertebræ), and probably also to certain tubular parts of the urogenital system. But, although its subsequent changes are complex, when it first appears the cœlom consists of a pair of fissures in the mesoderm.

Only one precise account of the development of the cœlomatic fissures is known to me, namely, that of Bonnet, *6*, 202, for the sheep at about thirteen days. Around the embryo, at some distance from the axis, there appear a series of irregular fissures of rounded or elongated form, which may in part open on the mesodermic surface; gradually the fissures enlarge and fuse, at the same time becoming more closely bounded by the mesodermic cells; thus there arises a continuous cavity in the mesoderm, which is for a time crossed by cells and cell processes; meanwhile the cells which are loosely put together form a compact layer of epithelium bounding the cavity, which we can now designate as the *cœlom*, or primitive body cavity. By similar

processes the cœlom grows toward the axial region, but never penetrates it, the primitive streak and head-process never developing a cœlom. The changes which have taken place have now divided the mesoderm into two tissues: 1°, the *mesothelium* or epithelial lining of the body cavity; 2°, the *mesenchyma* comprising all the non-epithelial mesoderm. Whether in all cases the cœlom begins as a series of small spaces, which subsequently fuse, we are unable to say; but it is my no means improbable that such is the case. It is, I think, also probable that the cœlom begins always to appear at a little distance from the embryo, and spreads both centripetally and centrifugally. In the sheep the large size of the cœlomatic cavity is connected with the precocious development of the amnion.

Of other vertebrates we can say only that the cœlom appears, and is at first merely a narrow fissure. It divides the mesoderm into an upper leaf (Hautfaserblatt) and an inner or lower leaf (Darmfaserblatt); the former may be called the *somatic*, the latter the *splanchnic mesoderm*, as proposed by Balfour. The upper leaf lies close against the ectoderm; the two layers together form the *somatopleur*, or body wall. The lower leaf lies close against the entoderm; these two layers together form the *splanchnopleur*, or wall of the alimentary tract. Both the somatic leaf of mesoderm and the splanchnic comprise mesothelium and mesenchym; axially the two layers become continuous, both with one another and with the axial mesoderm. The mesothelium continues for some time to throw off cells, which add themselves to the mesenchym, but except for this the two tissues have each an entirely separate history, and the adult tissues derived from them form two well-defined and natural groups.

The morphology of the cœlom is so important that it is difficult to understand why so many investigators have slurred over the question of its embryonic development. Exact observations on its first appearance and on the first stages of its expansion in various types are urgently needed, and would certainly do more than anything else to throw light on the still obscure problem of the origin of the mesoderm.

Theories of the Mesoderm.[3]—From the time of Von Baer's Entwickelungsgeschichte, of which the first part appeared in 1828, until 1868, when W. His's great monograph on the chick, *16*, was published, embryologists recognized the three layers, and regarded the mesoderm as a natural unit. His led the way to our present conception by a little-known article, *15*, on the membranes and cavities of the body, and his monograph, *16*, above mentioned fully established the necessity of recognizing two main groups of mesodermic tissues. Accordingly he divided the mesoderm into two parts, the *archiblastic*[4] and *parablastic*, corresponding respectively essentially to mesothelium and and mesenchyma. Under archiblast, His included not only the mesothelial tissues proper, but also the smooth or organic musculature; under parablast the mesenchymic tissue, except the smooth muscle. The terms used corresponded to his theory of the origin of the two parts of the mesoderm, for he believed that the archiblast arose in the axial region, and was contained in the embryo from the start, while the parablast arose peripherally, and grew in towards the embryo, a conception which was perhaps suggested by the appearance of the blood-vessels first outside the embryo proper. Seeking still further for the source of the supposed peripheral parablast, he believed he had found it in the germinal wall. The study of the relations of the wall in the chick induced him to think that the elements of the white yolk became parablast cells; moreover, the study of the hen's ovary led him to the conclusion that the white yolk was developed from the granulosa cells, and that these cells arise from leucocytes. He thus traced back the parablastic cells to maternal leucocytes. It has been shown that the granulosa cells are not leucocytes, and that the granulosa cells do not enter the ovum; the white yolk-grains never become cells, for it has been proved that all nuclei of the segmentating ovum come from previous nuclei, and lie in protoplasm, not in the yolk-grains; and finally it has been shown in this chapter that the mesoderm arises, as a whole, not from double sources. Professor His's views as to the origin of the parablast

[3] See *ante* p. 880.

[4] His's archiblast includes the ectoderm, entoderm, and archiblastic mesoderm.

must, in my judgment, be given up; but this is no reason for overlooking, as certain writers have done, the fundamental significance of the distinction drawn between the two primary groups of mesodermic tissues. Subsequent research has made only one important change necessary, namely, the transfer of smooth musculature from one group to the other. In view of this change and of the fact that parablast has been used with various other meanings, and of the unaptness of His's names, since we renounce the theory they correspond to, it will be well to use exclusively the newer terms mesothelium and mesenchyma.

The parablast theory has been defended by His, *17*, and modified by him, *18*. At present he holds to the distinction originally drawn, but is inclined to withdraw his hypothesis of the origin of the parablast. A number of writers have agreed with His as to the separate peripheral development of the mesenchyma (parablast). Among those may be mentioned Rauber, *30*, *31*, and several authors who have dealt with the development of the blood. The most important of the disciples of His is Kollmann, who, in a series of articles, *22*, *23*, *24*, *25*, has maintained the double origin of the mesoderm. Of these papers the most important is that on the "Randwulst," or germinal wall, of the structure of which in the chick it gives an excellent description. Kollmann regards the germinal wall not as a part of the entoderm, but as a distinct organ composed of segmentation spheres, and destined to produce blood-vessels with blood, and probably also connective tissue; this peripheral anlage (Randkeim) he designates as *acroblast*, and the single cells derived from it he names *poreuten*. Waldeyer, *42*, has accepted the parablast theory, but with a modification by which he seeks to reconcile conflicting observations. His article is written with characteristic clearness and exhaustive mastery of the literature, and will be found especially valuable by those who wish to pursue this subject further. Waldeyer distinguishes between the primary and secondary segmentation; the former producing the ectoderm, entoderm, and archiblastic mesoderm; the latter occurring later, and giving rise to the parablast. This remnant of the ovum in holoblastic ova consists of cells; in meroblastic ova of

egg protoplasm, which has its cell division (segmentation) retarded, and the cells, whether early or tardily produced, immigrate into and between the germ-layers already developed.

The opposition to the parablast theory is the sum of numerous observations which, as pointed out in the previous part of this chapter, prove, it seems to me, that the mesoderm arises in all vertebrates (except mammals ?) as a unit, and subsequently separates into mesothelium and mesenchyma. The leading opponent of the separate origin of the parablast is Kölliker, in both his text-books (Entwickelungsgeschichte, etc., and Grundriss), and in separate articles (see especially *19*, *20*, and his criticism, *21*, of Kollmann). I agree with Kölliker that it has been sufficiently demonstrated that the "acroblast" belongs to the entoderm, and that after delamination of the mesoderm the acroblast is transformed into the epithelium of the yolk-sac; for a conclusive demonstration that this is so in reptiles, see H. Strahl, *40*.

The *cœlom theory* of the brothers Hertwig includes a fundamental modification of the parablast theory. The main features of the cœlom theory are not original with the Hertwigs, but may be found in previous writers. Nevertheless, they were the first to present the theory in a complete formula, and with a backing of facts, both new and collected from others, so extensive as to compel attention. In justice to E. Ray Lankester it must be stated that he is really the author of the cœlom theory, having, in 1877 (*27*, *A*), published the hypothesis that the cœlom is derived from the archenteron, and that the mesoderm of vertebrates represents solid entodermal diverticula. It is unfortunate that the Hertwigs have not made due acknowledgment of what they owed to Lankester and others. They made a series of investigations on the germ-layers of various representatives of the animal kingdom, and presented their general results in a comprehensive article (O. and R. Hertwig, *14*). O. Hertwig has again expounded the theory in his text-book of embryology. The cœlom theory consists of two parts: 1°, the cœlom is formed by diverticula of the archenteron and its lining; the mesothelium is part of the entoderm; 2°, the mesenchyma consists of cells thrown off by the germ-layers, and is essentially distinct from the

mesothelium. The value of this theory lay in the clearness of its formulation, thus facilitating discussion, and also in its bringing out the difference more clearly between the epithelial and the non-epithelial portions of the mesoderm. As we have seen, there is no evidence of a character to render even probable that part ot the cœlom of vertebrates represents archenteric diverticula; the whole mesoderm appears as a single germ-layer, which is subsequently differentiated into mesenchyma and mesothelium. Hence both essential parts of the cœlom theory are inapplicable, at least in the present state of our knowledge, to vertebrates. For further discussion of the difficulties of the Hertwigs' theory, see Rabl, *29*, 198–202. The Hertwigs recognized the significance of the parablast, and added the important rectification, which Flemming's observations had already rendered necessary, of separating the smooth muscles from the striated skeletal muscles, a separation the propriety of which was wrongly questioned by Balfour (*Comp. Embryol.*, II., 359). By this advance the two groups of mesodermal tissues became properly delaminated.

C. Rabl's theory of the mesoderm is based, it seems to me, wholly upon his failure to understand the law of concrescence. That the mesoderm appears (perhaps in all vertebrates) while concrescence is going on is well ascertained; consequently there is an axial mesoderm (Rabl's "gastrules mesoderm") where concrescence has taken place, and a lateral mesoderm (Rabl's "peristomales mesoderm") in the part of the blastodermic rim which has not concresced. Until Rabl proves that his "peristomales" mesoderm does not become axial mesoderm in later stages, his theory can have no standing. His memoir brings out one point of very great importance for the elucidation of the early stages of vertebrates, namely, that the "peristomal" mesoderm—in other words, that of the blastodermic rim in selachians and of the lips of the anus of Rusconi in amphibians—is represented in the amniota by the mesoderm of the primitive streak. If this interpretation, which is much strengthened by L. Will's researches on the Gecko, *44*, be verified, then the primitive streak is the homologue in amniota of the anus of Rusconi, and is the region where concrescence is incomplete; the head-process is

then the part where concrescence is finished. This concords with the observed fact that the head-process grows at the expense of the primitive streak, as it would do if concrescence continued.

The So-called Parablastic Nuclei of the Yolk.—In meroblastic vertebrate ova, after the embryo is formed, there appear in the yolk near its surface, underneath the extra embryonic blastoderm, peculiar large nuclei, which are commonly designated as the parablastic nuclei. The following description applies to Pristurus.[5] The extra embryonic ectoderm is a rather thin, much-flattened epithelium lying close to the yolk; below the ectoderm is the superficial layer of the yolk, a broad stratum of protoplasm with scattered small yolk-granules; a little deeper down a row of irregular vacuolar spaces, and again, a little deeeper, a layer of very big nuclei, each with a distinct intra-nuclear network and several deeply stained nucleoli; the nuclei vary in size, being from 2–5 times the diameter of the nuclei in the embryo. The upper part of the protoplasmatic stratum contains numerous small and a few larger yolk-grains, and contains near and under the embryo small nuclei; the middle part of the stratum contains the vacuoles, the big nuclei, and but few yolk grains; the deepest part contains larger granules, and merges gradually into the yolk proper (see also His, *18*, *75*, and Rückert, *32*). Rückert designates these nuclei as "*Merocytenkerne*," and the cells which they represent as "*Merocyten*." The special function of the protoplasmic layer appears to be the assimilation of the nutritive yolk. Rückert also maintains, but without proper evidence, it seems to me, that merocytes become cells, some of which join the ectoderm, some the entoderm, and yet others the mesenchyma. In the Sauropsida we find similar nuclei and similar relations of the nucleated layer, but in this type the protoplasmic layer becomes the epithelium of the yolk (see especially H. Strahl, *40*), and I consider it probable that these parablast nuclei in all meroblastic ova belong to the vitelline entoderm.

In holoblastic mammalian ova the vitelline entoderm is cellular, and no nuclei are known similar to the large "parablastic" nuclei of mesoblastic ova.

[5] From sections in the collection of Prof. His, which he generously permitted me to study.

AUTHORITIES CITED.

1. AGASSIZ, A., and WHITMAN, C. O. On the Development of Some Pelagic Fish Eggs. Preliminary notice. Proc. Am. Acad., XX., pp. 23–75, 1 Pl., 1884.

2. BALFOUR, F. M. A Monograph on the Development of the Elasmobranch Fishes. London, pp. 295, Pls. I.–XX., 1878.

3. BAMBECKE, V. Recherches sur le Développement du Pélobate Brun (*Pelobates fusus* Wagl.). Mem. Couron. Belg. Acad., XXXIV., 66 pp., 5 Pls., 1868.

4. BENEDEN, E. VAN, and JULIN, CHARLES. Recherches sur la Formation des Annexes Foetales chez les Mammifères (Lapin et Cheiroptères). Arch. Biol., V., fasc. 3, 369–434, Pls. XX.–XXIV., 1884.

5. BELLONCI, GUISEPPE. Blastoporo e linea primitiva dei Vertebrati. R. Acad. Lincei. Ser. 3, XIX., CCLXXXI., pp. 45. Taf. I.–VI., 1884.

6. BONNET, R. Beiträge zur Embryologie der Wiederkauer gewonnen am Schafen. Arch. f. Anat. u. Entwick., Anat. Abth., 170–230. Taf. IX.–XI., 1884.

7. CARIUS, FR. Ueber die Entwickelung der Chorda und der Primitiven Rachenhaut bei Meerschweinchen und Kaninchen. 8vo, pp. 33. Taf. I., Marburg, 1888.

8. DUVAL, MATTHIAS. De la Formation du Blastoderme dans l'oeuf d'oiseau. Ann. Sci. Nat. Zool., XVIII., Ser. 6, 1–208, Pls. I.–V., 1884.

9. GOETTE, A. Der Keim des Forelleneies (Beiträge zur Entwickelungsgeschichte der Wirbelthiere). M. Schultze's Arch. f. Mikr. Anat., IX., 679–708. Taf. XXVII., 1873.

10. ——, Die Entwickelungsgeschichte der Unke (*Bombinator igneus*) als Grundlage einer Vergleichenden Morphologie der Wirbelthiere. 8vo, p. 964. 4to, Atlas. Taf. XXII., Leipzig, 1875.

11. HEAPE, W. The Development of the Mole (*Talpa europea*). The Formation of the Germinal Layers, and Early Development of the Medullary Groove and Notochord. *Q. J. M. S.*, XXIII., 412–452, Pls. XXVIII.–XXXI. Studies Morph. Lab. Cambridge, II., 29–75, Pls. VI.–IX., 1883.

12. HERTWIG, O. Die Entwickelung der mittleren Keimblattes der Wirbelthiere. Jen. Z., XV., 286–340. Taf. XII.–XV., 1882.

13. ——. Die Entwickelung des mittleren Keimblattes der Wirbelthiere. Jena Z. Natur., XVI., 247–328. Taf. XIV.–XVIII., 1883.

14. HERTWIG, O. u. R. Die Coelom theorie: Versuch einer Erklärung des mittleren Keimblattes. Jena Zeitsch., XV., 1–150. Taf. I.–III., 1881.

15. HIS, W. Die Häute und Höhlen des Körpers. Basel, 34, 1865.

16. ——. Untersuchungen über die erste Anlage des Wirbelthierleibes. Die erste Entwickelung des Hühnchens im Ei. Leipzig, 237 pp., 12 Taf., 1868.

17. ——. Der Keimwall des Hühnereies und die Entstehung der Parablastischen Zellen. Zeitsch. f. Anat. u. Entwick., I., 274–287, 1876.

18. ——. Die Lehre von einem Bindesubstanzkeim (Parablast). Rückblick nebst Besprechung einiger neuerer Entwickelungsgeschichtlicher Arbeiten. Arch. f. Anat. u. Phys., Anat. Abth., 62–108, 1882.

19. Kölliker, A. Ueber die Nichtexistenz eines Embryonalen Bindegewebskeims (Parablasts). Sitzb. Phys. Med. Ges. Würzburg, 14–18, 1884.

20. ——. Die Embryonalen Keimblätter und die Gewebe (und Nachtrag). Z. Z., XL., 179–213. Taf. XI.–XII., 336–357, 1884.

21. ——. Kollmann's Akroblast. Z. Z., XLI., 155–158, 1885.

22. Kollmann, J. Der Mesoblast und die Entwicklung der Gewebe bei Wirbelthieren. Biol. Centrabl., III., No. 24, pp. 737–747, 1884.

23. ——. Der Randwulst und der Ursprung der Stutzsubstanz (und Nachwort). Arch. f. Anat. u. Phys., Anat. Abth., 341–434. Taf. XVI.–XVIII., 461–465, 1884.

24. ——. Gemeinsame Entwickelungsbahnen der Wirbelthiere. His's Arch., 279–306. Taf. XII., 1885.

25. ——. Ueber Gemeinsame Entwickelungsbahnen der Wirbelthiere. Zeit. Wiss. Zool., XLI., 517–524, 1885.

26. Kowalewski, Miecz von. Ueber die ersten Entwickelungsprocess der Knochenfische. Z. Z., XLIII., 434–480. Taf. XVII., 1886.

27. Lampert, K. Zur Genese der Chorda Dorsalis beim Axolotl. Sitzb. Phys. Med. Soc. Erlangen, 37–57. Taf. I., 1883.

27*a*. Lankester, E. Ray. Notes on Embryology and Classification. *Quar. Jour. Micr. Sci.*, XVII., 399–454, Pl. XXV., 1877.

28. Lieberkühn, N. Ueber die Chorda Sangethieren. Arch. f. Anat. u. Phys., Anat. Abth., 399–438. Taf. XX.–XXI., 1882.

29. Rabl, Carl. Theorie des Mesoderms. Morph. Jb., XV., 113–250. Taf. VII.–X., 1889.

30. Rauber, A. Ueber den Ursprung des Blutes und der Bindesubstanzen. Sitzb. Natforsch. Ges., Leipzig, 1877.

31. ——. Die Entwickelung der Gewebe und die Sitz. Natforsch. Ges., Leipzig, 1883.

32. Rückert, J. Zur Keimblattbildung bei Selachiern Ein Beitrag zur Lehre vom Parablast. 8vo, pp. 58, München, 1885.

33. ——. Ueber die Anlange des Mittleren Keimblattes und die erste Blutbildung bei Torpedo. Anat. Anz., II., No. 4, pp. 97–112; No. 6, 154–176, 1887.

34. Ryder, John A. A Contribution to the Embryology of Osseous Fishes, with Special Reference to the Development of the Cod (*Gadus morrhua*). Ann. Rept. Com. Fish and Fisheries for 1882. Pls. I.–XII., 1884.

35. Schultze, Oskar. Die Entwickelung der Keimblätter und der Chorda Dorsalis von Rana fusca. Zeit. Wiss. Zool., XLVII., 325–352. Taf. XXVIII.–XXIX., 1888.

36. SCHWARZ, D. Untersuchungen der Schwanzendes bei Embryonen der Wirbelthiere. Zeit. Wiss. Zool., XLVIII., Heft 2, 191–224. Taf. XII.–XIV., 1889.

37. SELENKA, E. Studien über Entwickelungsgeschichte der Thiere, Heft IV. Das Opossum (*Didelphys virginiana*). 1 Hälfte, Wiesbaden, 1886.

38. SHIPLEY, ARTHUR E. On Some Points in the Development of *Petromyzon fluviatilis*. *Quar. Jour. Micr. Sci.*, XXVII., 325–370. Pls. XXVI.–XXIX. Studies Morph. Lab. Cambridge, IV., 173–218, Pls. XVIII.–XXI., 1888.

39. STRAHL, H. Beiträge zur Entwickelung der Reptilien. His's Arch., Anat. Abth., 1–43. Taf. I., 1883.

40. ——. Die Dottersackswand und der Parablast der Eidechse. Z. Z., XLV., No. 1, 283–307. Taf. XVI., 1887.

41. SWAEN, A. Etudes sur le Développement de la Torpille (*Torpedo ocellata*). Arch. de Biol., VII., 537–585, Pls. XIV.–XVI., 1887.

42. WALDEYER, W. Archiblast and Parablast. Arch. f. Mikr. Anat., XXII., 1–77. Z. thiel Allgemeine Anatomie, 1883.

43. WELDON, A. B. Note on the Early Development of *Lacerta muralis*. *Q. J. M. S.*, XXIII., 134–144, Pls. IV.–VI. *Also in* Sedgwick's Studies, II., 1–12, Pls. I.–III., 1883.

44. WILL, L. Bericht über Studien zur Entwickelungsgeschichte von *Platydactylus mauritanicus*. Sitzb. Kon. Preus. Akad. Wiss. Berlin, LII., 1121–1228, 1889.

45. ZIEGLER, H. E. Die Embryonale Entwickelung bei Salmo salar. Freiburg (Diss.), 1882.

46. ZUMSTEIN, J. J. Ueber das Mesoderm der Vogelkeimscheibe (Huhn und Ente). 8 vo., p. 56. Bern (Inaug. Diss.), 1887

THE EVOLUTION OF MIND.

BY E. D. COPE.

BEFORE entering on this subject we must consider the nature of mentality. Mental acts display a great range from simple to complex. An attempt is made to exhibit their relations in the following table:

Class I. Perceptions (presentations).
Class II. Ideas (representations).
- Division A. Memory of Perceptions.
- Division B. Affection (taste, emotion).
- Division C. Imagination.
- Division D. Ratiocination.
  - Method A. Conception (generalization).
    - 1st Grade.
    - 2d Grade.
    - 3d Grade, etc., etc.
  - Method B. Induction (inference).
    - 1st Grade.
    - 2d Grade.
    - 3d Grade, etc.
  - Method C. Deduction (predication).
- Division E. Will.

The divisions of this table are not mutually exclusive. With regard to the methods of Ratiocination as above enumerated, it is to be noted that Induction and Deduction are distinct in kind from Conception, and are based on the latter, as well as on the simple Memory of Perceptions (Division A). While Conceptions are classifications, Induction and Deduction follow the Memory of Perceptions whether classified or simple. Will is expressed in action induced by any of the faculties embraced in the four preceding divisions.

In this chapter I will first compare the mental faculties of man and the animals below him, and will then consider their progressive evolution.

I. CONSCIOUSNESS.

The faculties of perception or observation, form the primary division of mental processes, and the most simple. They include those of general sensation and of special sensation. To the latter belong smell, hearing, taste, and sight; to the former, touch, temperature, muscular sense, etc. It may be inquired, What have these functions in common with the affections, the intelligence, and the will? They have the important characteristic in common, that they are all forms of consciousness, or self-knowledge. All of these functions are forms of consciousness, although some of the representative faculties may become automatic and unconscious after education. Consciousness, then, is the one common property of all mind; and, from the point of view of the evolutionist, progressive development of mind is the advance from the simpler to the more complex, or from the generalized to the specialized forms of consciousness. Mind, then, in this general sense, embraces every and all kinds of metaphysical condition, including the unconscious derivatives of conscious antecedents. Of this latter mental type more will be said later.

That many of the higher animals possess mental faculties which must be referred to the divisions of the intelligence and the affections, is evident to every person who is familiar with the animals themselves. That the simpler affections or "instincts" are present in animals very far down in the scale, is also obvious. That special senses exist in animals as low down as the Cœlenterata has been shown by Dr. Romanes and Prof. Eimer. General sensation is probably present in still lower forms of life; but which of them possess this simplest form of consciousness, and which do not, is at present very difficult to state. We may, however, form an estimate of probabilities in the case by observing the movements of Protozoa under stimuli, as well as those of the spermatozoöids and phagocytes, which have a free existence within the bodies of all but the lower forms of life.

The test of the presence of conciousness as the condition of the performance of an act is to be found in the nature of the act. Consciousness may be supposed to be necessary to the performance of an act which displays a definite relation to the satisfaction of some need of the animal; but such an act does not necessarily prove that consciousness is present at the moment of action. It is well known that designed acts may be performed by the higher animals which have been deprived of their nervous sensory centers. Thus many vertebrates respond to stimuli applied to the extremities of their peripheral nervous system after the removal of the brain; such movements are entirely appropriate to the stimulus, being directed to the removal of the source of the irritation. The presence of consciousness (or sensation) cannot be predicated on movements of this kind. In fact, many kinds of movements of considerable complexity are unconsciously performed by man with uninjured sensory centers, in consequence of their subjection to the process of automatization, which is education, of the centers. By continued repetition a given movement may be learned, so that consciousness is not necessary to its performance, as for instance, knitting and reading aloud. Walking and other comparatively simple movements may be still more readily performed in unconsciousness. It is certain that even some of the higher functions of the brain, as classification, may be so performed. On account of these well-known phenomena it is supposed by a class of thinkers that consciousness has not been necessary to the original performance of any act, no matter how complex it may be, and no matter how evident the design. They suppose that action has been promiscuous or multifarious, and that natural selection has preserved those individuals whose movements chanced to be beneficial, and that those whose movements have been of a useless or injurious kind have been destroyed.

There are two objections to this explanation of the origin of designed movements. The first is, that in all cases where we have the opportunity of observing the origin and development of such acts, we find that they have to be learned, and that they only become automatic after a more or less prolonged period of education. This process of education is one that involves the pres-

ence of consciousness, or the experience of pleasures and pains, as consequences of movements. The movements are first performed under the experience of the necessity of securing the one, and of avoiding the other; a desire which is a condition of consciousness wherever it exists. Another objection to the explanation of the origin of designed acts by fortuity and natural selection, is identical in character with that which has been urged against the similar explanation of the origin of permanent variations of structure. The chance of the accidental performance of profitable movements among all possible movements, is very small; and the chance of the repetition of such movements by a sufficiently large number of individuals to cause them to be preserved by reproduction and inheritance is much smaller. In order to preserve such movements so that they should become habitual in a single individual, it would be necessary they they should be performed by it frequently,—a probability which diminishes directly in proportion to the frequency required to produce that result. Thus our negative knowledge of this subject agrees with our positive knowledge in impressing us with the extreme improbability of a single habitual designed act having arisen and been perpetuated by chance.

It is sometimes doubted whether consciousness can exist in such simple beings as the Protozoa. But this doubt seems to be unnecessary after a consideration of the organization of such higher forms of life as we know to be conscious. The higher multicellular animals, or Metazoa, consist of a colony of cells which display different degrees of specialization for the performance of the different functions to which evolution assigned them. Their degree of specialization is of course measured by their degree of departure from the simple, primitive nucleated cells from which they have been derived by descent. Perhaps the most specialized are those which have become the threads of the connective and elastic tissues, and those of the tendons. Those of the modified epithelial tissues which cover the integument of the body, with its appendages, as scales, nails, horns, and hairs, are also highly modified. Muscular tissue is a little less specialized. In none of these tissues do we find consciousness. It is not cer-

tain that sensation resides in any but the cells of the nervous system, and if those of the peripheral parts of the system possess it, they do not retain it if they lose their connection with the central system. Now the cells of this system are the least modified of all those that constitute the soma of the metazoon, and thus they resemble most nearly the simple beings which constitute the lowest forms of the Protozoa. If they are capable of sensation in the one case they are likely to do so in the other. It appears that the conscious cell is the primitive cell, and the unconscious cell is the modified or specialized cell. And this conclusion coincides with what we know of the relation of consciousness to function in the animals in which we can examine the history of both. Specialization of structure means specialization of function; and specialization of function means accomplished education. Completed education, as we have already seen, means unconsciousness, while consciousness is necessary to the beginnings of education, and to its successive steps up to completion. We are then led by the analogies of the education of tissues, as well as by their structure, to the belief in the presence of consciousness in the Protozoa. The demonstration of a sense analogous to sight in the Infusoria by Klebs and Pouchet, and in the Cœlenterata by Romanes and Eimer, renders it unnecessary to pursue the argument further into the next higher type of the animal kingdom.

Were the above reasons insufficient to lead us to our conclusion, a consideration of the movements of the Protozoa would do so. All authorities agree that some of the actions of the Infusoria are in no sense automatic, but display a design as appropriate to the occasion as do those of the highest animals. The movements of the body of these animals are definitely directed towards their food or prey, and towards their opposite sex, and as definitely directed away from dangerous enemies. The movements of particular parts of their bodies, as of their cilia and flagella, have definitely designed movements for special occasions. Some of the movements of the Amœbæ have been, probably correctly, regarded as having a purely physical origin, due to the mobility of their protoplasm, and their contractility; but others, such as the projection of pseudopodia towards food with which they are not

already in contact, cannot be explained in this way. Their selection of food and rejection of injurious substances, though not always performed without errors, indicates the presence of sensation. The building of external protecting envelopes composed of grains of solid substances by the Difflugiæ cannot be explained by the action of physical causes only; and the arrangement of pieces in regular order as an envelope by the Rotifer Melicerta indicates still more definitely the presence of consciousness in some form.

We cannot discover any such design in the movements of phagocytes and of spermatozoöids. The former engulf leucocytes and other bodies with which they come in contact, very possibly for physical reasons, but do not pursue them, nor indicate their perception of their presence in any way. The movements of spermatozoöids appear to be without direction other than that given them by the vibrations of their flagella, by the cilia of the canals which they traverse, and perhaps by some physical attraction not at present explainable. The attraction of the spermatozoöids of certain ferns and hepaticæ by solutions of malic acid and cane sugar have been regarded as chemical, but this can scarcely be the correct explanation. A physical relation is much more probable, if sensation is excluded.

The presence of predication cannot be inferred from the existence of consciousness in the lowest forms of life. An action is designed if it is a response to a present stimulus or sensation, even if there be no memory, and the act is a new one every time the stimulus is applied. It is evident, however, that education commences low in the scale, since some of the acts of the Infusoria indicate an adaptation of means to ends which cannot be supposed to be possible to a totally new experience. The discharge of the weapon-like cilia of the Dinidium at its prey would indicate that the animal knew the effect of the act from past experience, and anticipated that food would be secured in this way from its success in previous performances of the kind. Memory is, so far as we know, a general attribute of living protoplasm, and it is probable that it enters into the psychic acts of very low organisms. It may be in the beginning unconscious

memory,—merely the habit of identical response to identical stimuli, on the principle that energy in organic substances most easily traverses accustomed channels. But it is not easy to believe in a stimulus which is not consciously felt producing anything but an undesigned, indefinite movement; and memory, conscious or unconscious, could only repeat it. A movement directly related to the satisfaction of sensation could only originate in a sensation, and the unconscious memory would repeat it blindly on the occasion of the experience of an identical stimulus. So soon as conscious memory should appear, the possibility of more exact adaptation or design in an act would appear. Variations in the act appropriate to variations in the stimulus would become possible. We may suspect conscious memory in the exact ratio of the appearance of predication under slightly varied circumstances, when narrower resemblances and differences are evidently to be taken into account. In such cases comparisons of memories are necessary, and rudimentary classification begins.

Mr. Romanes, in his work, "Mental Evolution in Animals," gives the following as his "criterion of mind": "The criterion of mind, ejectively considered, consists in the exhibition of Choice, and the evidence of Choice we found to consist in the performance of adaptive action suited to meet circumstances which have not been of such frequent or invariable occurrence in the life-history of the race as to have been specially and antecedently provided for in the individual by the inherited structure of its nervous system." This is an excellent definition of mind which has reached the stage of predication. But for purposes of classification, I should include all the phenomena of consciousness in the domain of mind, as distinguished from that of no-mind or physical energy. Such is the custom of metaphysical writers, who include perception within the range of their science, as it seems to me properly. The simple sensations should be included within the realm of mind. Here also should be included the "subconscious" state, with which we are all more or less familiar. Thus an impression may be made on the mind while its principal consciousness is otherwise occupied, and this impression may lead to attention, which is followed by a more distinct impression, if the cause of it

is still present. And the subconscious impression may be recorded as a memory, but not so thoroughly as if the impression were more distinct. Thus, the fleeting pictures of dreams are feebly impressed and but slightly recorded as memories. Such subconscious states may well be frequent in animals, especially in those where the external conditions are uniform, and new stimuli infrequent, for longer or shorter periods. But vigorous stimuli, as appeals to the general or special senses, quickly rouse animals, as well as man, to intense degrees of consciousness.

Since the sense-perceptions are well known to exist in animals, I will not give further special attention to them. Memory need not be especially considered, as its existence is necessary to the activity of all mental processes. I therefore proceed to the illustrations of the affections and the reason as observable in animals below man. Equally necessary to the existence of both affection and reason is association. Association of pleasures or pains with given objects forms the basis of liking and disliking, and of designed or rational action with regard to them. The more especial characters displayed by association will be especially treated of under the head of the reason or intelligence.

2. THE AFFECTIONS.

Preferences for especial articles of food and drink are known to characterize animals, not only on the ground of physiological necessity, but for reasons less easily explained. Reasoning from our own experience, we may ascribe the latter class of preferences to the gustatory sense, which is stimulated by certain flavors, and which rejects others. The gustatory sense, together with its near ally, the olfactory, is generally a safe guide to the function of assimilation, but not always, and in mankind it is often quite whimsical. In general, all of the "appetites" are common to man and the other animals.

More pronounced likes and dislikes are common among animals, and these are to be generally attributed to the action of association of memories, pleasant and unpleasant. The smell and sight of blood create the greatest excitement among animals of the ox kind, so much so that even the color red stimulates the

antagonistic passions of the bull. The action of association is here evident. The dog associates the gun with the chase, and as soon as he sees his master take it up his passion for hunting his food is aroused, and his joy is demonstrative. Sudden movements near a hive of bees or a nest of hornets (*Vespa maculata*) are unsafe, as these insects evidently anticipate danger, and proceed at once to attack the supposed enemy. The emotion of fear of all degrees is well-nigh universal in the animal kingdom, as few species, from the Protozoa upwards, do not endeavor to escape a present or anticipated danger. In no animal is fear more strongly developed than in some of the monkeys. A *Cebus capucinus* and a *C. apella* in my possession sometimes escaped from their cage, and could only be caught after a vigorous chase. In pursuit they became so terrified as to fall in an unconscious condition on the floor. They were cold when picked up, but they soon recovered. I have never known any other species of animal to faint from fright.

The social affections are seen low in the scale, and the maternal instinct is the first to present itself to our notice in the order of development. The endeavors of females to protect their eggs may be due to the fact that they regard them as part of their own bodies, as in the case of spiders, but an altruistic feeling (in the selfish sense of the word) must be admitted to be present in the exercise of the care of the young. This affection appears sporadically among invertebrate animals, but is very general among Vertebrata, becoming a master passion in many of them. The attraction of the female for the male is seen in low forms of life, where it is transient, and often little or not at all reciprocated on the part of the female, so that contrivances for the compulsory fertilization of the latter by the former are numerous. In the higher forms the affection is more or less reciprocal, and in the highest forms a distinct conjugal affection is developed. Whether this exists in forms below the birds is uncertain. Rattlesnakes associate in pairs, as do also sword-fishes. An account is given by Brown Goode of a furious and successful assault on a boat made by a sword-fish whose mate had been harpooned and captured by the boat's crew. Mutual affection between two individ-

uals of the same or of different species, without regard to sex, is not uncommon among birds and in mammals, and is probably an outgrowth of the maternal and sex instincts. The affection of many of the Mammalia for their human masters is well known, although this sentiment differs greatly in degree in individuals o fthe same species, as, for instance, in the dog.

Shame is evidently experienced by some of the Mammalia, especially by monkeys and by dogs. This affection is an anticipation of the ethical sense, a quality which will be considered under the head of the intelligence, further on.

Jealousy is strongly developed in Mammalia, especially among dogs. It is quite as obvious among these animals as among human beings. An illustration of jealousy on the part of a chimpanzee used frequently to amuse the visitors to the Zoological Garden of Philadelphia. It was the custom of the keeper to feed a pair of these animals together with bread and milk, using a spoon. One sat on each side of him with an arm placed about his waist, and the keeper fed them alternately. At times he would intentionally neglect one or the other of them. As this continued the neglected animal showed his displeasure by pouting the lips, and finally he would rush from the side of the keeper, and throwing himself on his back would give way to a burst of jealous rage. He kicked his feet, threw straw into the air, and screamed vigorously, the whole proceeding resembling what one sometimes sees in a spoiled child. On the offer of renewed attention from the keeper, the chimpanzee was pacified, and took his original position with great satisfaction.

Another and older chimpanzee confined in the same garden became paralyzed in the posterior limbs. Two lemurs (*L. catta.*) were given to it for company. Their playful activity was at times a source of irritation to the chimpanzee. Her grimaces and cries of rage at these harmless creatures were laughable, and her impotent attempts to dislodge them from their hold above her, by shaking the wood-work on which they rested, was an exhibition of passion which was quite ridiculous.

Admiration for brilliant or impressive colors or forms is evidently experienced by the vertebrate animals. It is probably present

much lower in the scale. Protozoa collect about the light, and show a decided preference for certain colors. This attraction is of course of a low type of mentality, expressive of a simple form of consciousness, but it cannot certainly be ascribed to chemical or physical causes. In any case it acts through sensation. Insects are believed to be attracted by showy flowers. Among vertebrates, birds show the most evident admiration for bright colors. The bower-birds (Ptilonorhynchus, Chlamydera, etc.) collect brightly-colored objects and arrange them about their play-houses and nests. The attention which the females of many birds which have brilliantly-colored males give to their exhibitions of themselves by the latter, is well known. The attractions thus offered to the females give opportunity for the sexual selection of Darwin and Wallace, which has no doubt had much to do with the preservation of beauty and other admirable variations of animal type.

A most evident illustration of admiration for brilliant color and extraordinary form was furnished by the monkeys in the Zoological Garden of Cincinnati. A large adult male mandrill (*Cynocephalus mormon*) was confined in a large cage with numerous smaller species of the old world monkeys. The mandrill had reached the age when the crest, beard, and bright blue, vermilion, and purple colors of the skin were in perfection. The smaller monkeys displayed the most respectful admiration for the huge beast, who stood or sat in the middle of the cage and received their adulation. The smaller species gazed upon the wonderful harlequin and moved about him in a deferential manner. His majesty occasionally seized one of them by the tail or the hind leg, and after submitting him to an examination, flung him from him with an expression of contempt. This did not seem to check their devotions, however, and they continued moving about him in circles and gazing at him.

3. RATIOCINATION.

In this section I will endeavor to state the character of the mentality of animals with respect to the faculty of reason, and to compare the latter with the corresponding department of the mind of man. Considerable light as to the essential nature of

reason must be gained from this research. It is well known that three distinct views may be taken of the source of this important faculty. These positions are the two extremes of realism and idealism, and the intermediate one maintained by Kant. According to Locke and the experiential school reason is a product of sense-perception or experience, and is *a posteriori*. According to Berkeley, Hegel, and the idealists, this faculty is *a priori* or intuitive, and creates the material world in its own likeness. Of this likeness sense-perception is the expression. According to Kant, sense-perception of a real universe is the material of thought, but it can only be comprehended through the necessary logical form of thought, which therefore presents a real material world to us in this form, but not as it is in itself. The relation which the evolution of mind has to this question will be considered in another essay.

Conception.—While perception and emotion are very generally granted to animals, it has been often denied that they are capable of conception or generalization. The formation of a concept is a result of classification, and the general idea which is a concept, is not an object, but a mental picture of several objects or parts of objects in combination. Concepts are of various grades of generality, as may be exhibited in the following table:

			Energy.			3
		Color.		Other kinds of Energy.		2
	Red or redness.		Yellow or yellowness.			1
Red thing No. 1.	R. t. No. 2.	R. t. No. 3.	Yellow thing No. 1.	Y. t. No. 2.	Y. t No. 3.	

In the above analysis three grades of generalization are represented; all derived from the individual objects enumerated in the bottom line. Each one requires successively greater mental grasp, and in the case of the highest generalization, the especial knowledge attained only by the scientific man. But the first or lowest grade of generalization is clearly within the scope of the animal mind. Thus the bull attacks a red object without ascertaining especially whether it is blood or a red cloth; he sees only

the redness. So with the water-fowl seeking water. He alights on a surface of water when and where convenient, without discrimination as to the particular piece of water. The crow and other animals avoid man in general, without discrimination as the particular man, in the absence of special instruction. That this is an exact generalization is shown by the usual indifference of such birds, etc., to cattle and other, to them, innocuous animals. In fact, it is quite easy to show, as Mr. Romanes has done, that a low grade of generalization is common to most animals, and that it is quite as natural to them as the particularization of individuals. That they are at the same time not incapable of particularization is easily seen. The water-bird ultimately seeks its accustomed locality for breeding. The bird or mammal learns to know its master, and to distinguish him from other persons by their confidence and friendship.

It is claimed by Professor Max Müller and other persons, that conception is impossible without language; *i.e.*, that it is impossible to form concepts without words to represent them as symbols. Now this is clearly not the case. The naturalist conceives his genera, orders, classes, etc., before he names them. One can readily conceive of redness, yellowness, etc., without naming them, and it is perfectly evident that many animals below man do the same.[1] It is only a question of the mental power of the individual as to how wide a generalization he can thus conceive.[2] I see no reason why this power may not extend to the highest possible grade of generalization in the most able of human minds. Nevertheless to most persons symbols or names are necessary to the accomplishment of the higher concepts. Names constitute an invaluable aid in the construction of rational edifices. They are well compared to a scaffolding to a building, and it is quite possible, as Romanes remarks, for a grade of conception thus attained to need the aid of words

[1] This has been well shown by Mr. Romanes in his Mental Evolution of Man, Origin of Human Faculty, Chap. III.

[2] For this reason I do not see the necessity for the subtraction of the lowest grade of concepts under the name of "recepts," as has been proposed by Mr. Romanes, *l.c.* Chap. II. Other grades of generalization might be as readily separated under distinct names.

no longer, and to become automatic, and a part of the mental furniture. That the use of words has been the cause of an acceleration of rational development in man there can be no doubt; but the mentality of the lower animals contradicts the supposition that it was entirely essential.

Many of the mammalia understand human language. They understand the meaning of words apart from tone and gesture. This can be most frequently seen in dogs, some of whom become remarkably expert in carrying out orders from their masters. Examples of this kind are familiar to many persons. Now the giving of orders involves the use of verbs. Verbs do not represent objects, nor do they represent even single acts, but they express a class of single acts. In the comprehension of a verb, a dog performs an act of simple generalization, distinctly above the mere recognition of an object by a name.

Induction.—Most evident is the existence in animals of the faculty of induction, which involves a generalization; *i.e.*, the drawing of a single general inference from a number of instances. While pure conception expresses cognition only, induction infers action on the part of its objects. From such and such premises, such and such events will follow, either as coincidence or as effect.

I now give some illustrations of experiential inference, and deductive or practical application, among the lower animals.

A great many animals adopt methods of concealment to escape observation, both of enemies and of the prey they seek. Certain species of crabs attach to their carapace pieces of algæ, which then vegetate and cover the animal with a growth which conceals it. Others carry a stone above the posterior part of the carapace, which serves as a basis of attachment for foreign organic growths which conceal them. Still others permit the growth of sponges and actiniæ on various portions of their surface, which sometimes cover them completely from view. Among birds peculiar attitudes are adopted, which serve as an effective concealment; such are those of some of the herons, which stand bolt upright in growths of reeds and thickets, so as not to be distinguished from the surrounding stems and trunks. So the

Gallinæ and some of the snipe family squat on ground, which they resemble in color, until danger has passed. An ingenious device is employed by certain green snakes of North America (*Liopeltis vernalis*). They burrow under the earth, and then permit the head and a few inches of the body to emerge. This portion of the body is held rigidly vertical, and is not distinguishable on a cursory view from the shoots and stems of green vegetation which surround it.

Fear sometimes stimulates an animal with the desire to inspire fear in return. I once observed this in the conduct of a *Heterodon platyrhinus* (hog-nose adder), which was kept in a cage with a water-snake (*Natrix sipedon*) and a copperhead (*Ancistrodon contortrix*). Both of the harmless species were evidently greatly frightened on the introduction of the copperhead into the cage. The water-snake sought the lowest spot in the sand on the bottom of the cage, and coiling up kept close to the ground, not even raising his head. The Heterodon, on the contrary, inflated his long lung, swelling the greater part of his body into the form of a cylindrical bladder. He at the same time extended the anterior ribs, so that this part of the body resembled the thin blade of a paper-cutter. He then plunged his nose into the sand, and covered the top of his head with as large a pile of that substance as it would carry. In this disfigured condition he paraded slowly about the cage in front of the copperhead. The latter moved but little, and showed no disposition to provoke a quarrel with its singular companion. The *Heterodon platyrhinus*, when disturbed by man, throws itself into vigorous contortions, spreads the anterior ribs, and opens the mouth widely, after the manner of a venomous snake. The habit of erecting, under the stimulus of fear, the feathers and hair in order to increase the apparent size of the body, and so inspire fear, is common among birds and mammalia. The artificial ferocity of many monkeys, while under the influence of the very opposite emotion, *i.e.*, fear, is often very amusing. Monkeys generally look away from a person whom they wish to attack, so as to throw the latter most completely off his guard.

(*To be continued.*)

THE HARVEST SPIDERS OF NORTH AMERICA.[1]

BY CLARENCE M. WEED.

THE harvest spiders, harvest men, daddy-long-legs, or grab-for-gray-bears, as they are variously known in different parts of the United States, form a distinct family—Phalangidæ—of Arachnida, which has as yet received comparatively little attention at the hands of American entomologists. In zoological classification the family belongs to the suborder Opileonea, of the order Arthrogastra, and sub-class Arachnida.

The Phalangidæ are at once distinguished from other Arachnids by the united cephalothorax and abdomen, the long legs with multiarticulate tarsi, the well-developed palpi and tarsal claws, the five or six ventral segments, the first of which is abruptly contracted in front and prolonged forward between the coxæ, and the two eyes close together upon an eminence at the middle of the dorsum of the cephalothorax.

Our knowledge of American harvest spiders dates from the time of Thomas Say, who, in 1821, described four species under the genus Phalangium. Half a century later Dr. H. C. Wood redescribed Say's species, and added eleven others to the list. Since then five additional species have been described by the present writer, who has also referred the others to their modern genera.

During a recent study of the Phalangidæ of the United States, as represented by collections made, largely through the kindness of entomological friends, in thirteen widely separated States, I have been able to recognize all of the described species, except two, viz., *P. grande* Say, occurring in the Southern States, and *P. exilipes* Wood, from the California coast. At least four of our forms fall into the subfamily Schlerosomatinæ, which has not before been recognized in our fauna. One species, the *P. nigrum* of Say, apparently belongs to the genus Astrobunus Thorell, while two of Wood's species, *bicolor* and *favosum*, will apparently require the erection of new genera to contain them, although at

[1] Read before Section F., A. A. A. S., at Indianapolis meeting.

present provisionally retained under Astrobunus, where also Say's *grande* may conveniently remain until the discovery of specimens enables it to be properly placed.

At least four genera of the subfamily Phalangiinæ occur in our fauna. Three of these have before been characterized, while the fourth is new. The first, and in number of species by far the largest, genus is Liobunum of C. Koch, which is characterized by having the palpal claw denticulate, and the maxillary lobes of the second pair of legs clavate in shape, enlarging from the base to the apex. Ten of our species, one of which is yet undescribed, belong to this genus, and two others—*exilipes* and *calcar*—are provisionally retained in it.

Closely allied to Liobunum, but easily distinguished from it, is a genus as yet uncharacterized, for which the name Forbesium is proposed, in honor of Professor S. A. Forbes, Director of the Illinois State Laboratory of Natural History. Its characters are as follows:

Teguments very soft. Anterior and lateral borders of the cephalothorax smooth. Eye-eminence distinct, entirely smooth, not canaliculate; separated from the anterior border by a space equal to its diameter. Lateral pores large, oval, marginal, with a deep oblique sinus behind each. Entire dorsal surface smooth, without tubercles or spines. Anal piece large, transversely oval. Mandibles short, similar in the two sexes, the first joint provided on the under side, near the base, with a distinct tooth. Palpi slender, rather long, the patella having a well-developed conical tubercle on its inner distal angle; claw denticulate. Maxillary lobes of second legs in the form of elongate triangles, as shown at Fig. 3, Plate XXX. Legs rather stout, and of only moderate length.

Members of this genus are at once distinguished from those of Liobunum by the elongated triangular maxillary lobes of the second pair of feet, the conical projection on the palpal patella, and the perfectly smooth uncanaliculate eye-eminence. In Simon's synopsis of European genera it comes between Liobunum and Prosalpia, but it also differs materially from the latter.

Two species of Forbesium occur in our fauna, the first, *F. formosum*, having been described many years ago by Dr. H. C. Wood, and the second, which may be called *F. hyemale*, being undescribed. The former is a distinctively northern species, ranging from New York to Colorado, while the latter is evidently its southern representative. Both are exceptional in that they hibernate as adults rather than in the egg state.

The undescribed species is represented at Plate XXXI., Fig. 1, showing its natural size, and Fig. 2 its structural details magnified: *a*, representing a dorsal view of the body; *b*, a side view of the eye-eminence; *c*, a front view of the same; *d*, a side view of the palpus; and *e* a similar view of the palpal claw. It may be described as follows:

Forbesium hyemale.—Female.—Pl. XXXI., Fig. 1, 2. Length, 7 mm.; width, 4 mm. Legs: I., 32 mm.; II., 60 mm.; III., 31 mm.; IV., 45 mm. Body soft. Dorsum smooth; mottled cinnamon-brown. A distinct dark central marking begins at eye-eminence, and runs two-thirds of the way to the posterior extremity; it contracts near the anterior border of the abdomen, then expands in an even curve, and again contracts in a similar way. There is a deep oblique sinus just back of each lateral pore of cephalothorax. On the abdomen are scattered dark spots, arranged in irregular transverse series. Eye-eminence perfectly smooth; black about eyes with a light-brown longitudinal central marking; slightly longer than high; not at all canaliculate. Mandibles light gray, with tips blackish; sparsely provided with short black hairs. Palpi slender; mottled grayish-brown; all the joints provided with short, black, stiff, spinous hairs. Patella arched; its inner lateral distal angle produced into a pronounced conical tubercle. Tarsal claw distinctly pectinate. Ventral surface light gray. Legs long, rather stout; coxæ light gray, remaining joints mottled cinnamon-brown.

Described from three specimens taken at Auburn, Alabama, by Professor George F. Atkinson.

Plate XXX. represents *Forbesium formosum*, the mature female being shown natural size at Fig. 1, structural details magnified at Fig 2, and the maxillary lobes of the second legs at Fig. 3. Both plates are from drawings by Miss Freda Detmers.

The genus Phalangium as at present restricted contains but two of our forms, *cinereum* Wood and *longipalpis* Weed. *P. cinereum* is one of our commonest species, and occurs from New York to

PLATE XXX.

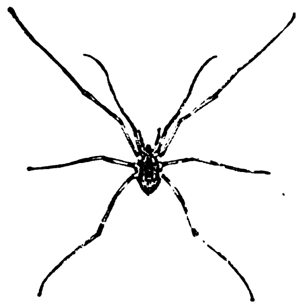


FIG. 1.

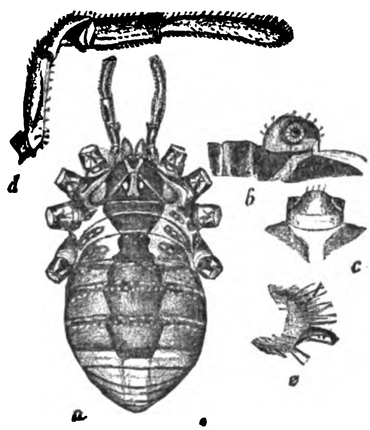


FIG. 2.

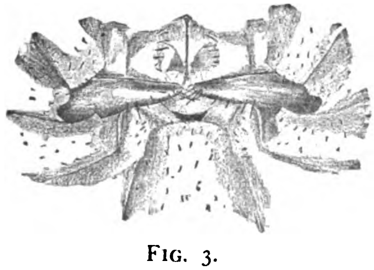


FIG. 3.

Forbesium formosum Wood.

PLATE XXXI.

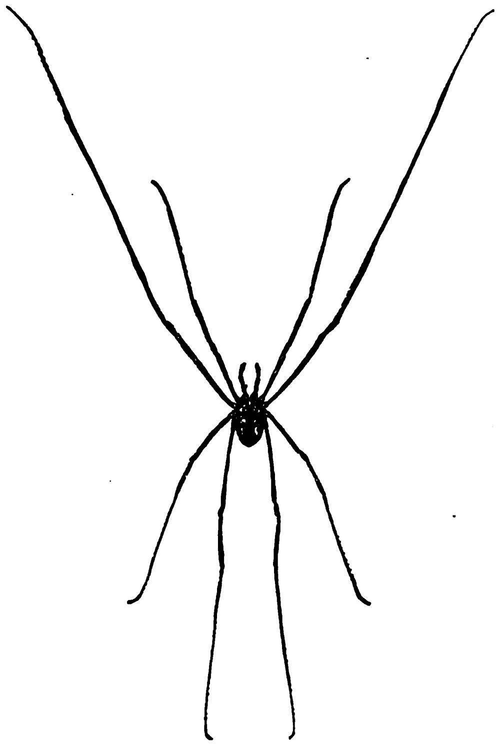


FIG. 2.

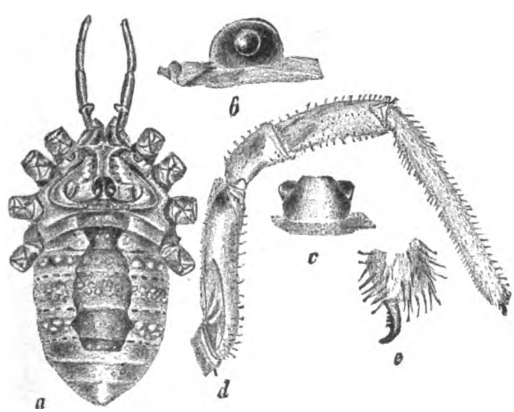


FIG. 2.

Forbesium hycmale Weed.

Nebraska, though apparently not extending into the Southern States. *P. longipalpis* is a southern form,—having been received as yet only from Arkansas,—which is remarkable for the extremely long palpi and abnormal cheliceræ of the male, while in the female the palpi are of the usual length and the cheliceræ normal in form.

Two species of the genus Oligolophus occur in our fauna. The first, *O. pictus* Wood, has been taken in Massachusetts, New York, Illinois, and Ohio. It is quite rare, though not so much so as the other, *O. ohioensis* Weed, which has as yet been found only in Illinois and Ohio.

Summarizing these statements, we find that, so far as at present known, the phalangid fauna of North America includes but twenty-two species, belonging to two subfamilies. The first subfamily, Sclerosomatinæ, claims four forms, one of which belongs to Astrobunus, while the generic position of the other three is at present in doubt. The subfamily Phalangiinæ includes four genera, viz., Liobunum with twelve species; Forbesium with two species; Phalangium with two species; and Oligolophus with two species.

It must be confessed that, for the area represented, this is a very small showing, and undoubtedly the list will be greatly lengthened when the fauna of the mountainous regions and the more remote sections of the country is better known. France has a list of fifty-nine of this family, and the phalangid fauna of other European countries is proportionately large.

List of North American Species.

Family *PHALANGIIDÆ*.

Subfamily SCLEROSOMATINÆ,

Genus Astrobunus Thorell.

1. *A. nigrum* Say.
2. *A.* (?) *bicolor* Wood.
3. *A.* (?) *favosum* Wood.
4. *A.* (?) *grande* Say.

Subfamily PHALANGIINÆ.

Genus LIOBUNUM Koch.

5. *L. dorsatum* Say.
6. *L. elegans* Weed.
7. *L. longipes* Weed.
8. *L. maculosum* Wood.
9. *L. nigripalpis* Wood.
10. *L. politus* Weed.
11. *L. similis* Weed (M S.).
12. *L. ventricosum* Wood.
13. *L. verrucosum* Wood.
14. *L. vittatum* Say.
15. *L.* (?) *exilipes* Wood.
16. *L.* (?) *calcar* Wood.

Genus FORBESIUM Weed.

17. *F. hyemale* Weed.
18. *F. formosum* Wood.

Genus PHALANGIUM Linn.

19. *P. cinereum* Wood.
20. *P. longipalpis* Weed.

Genus OLIGOLOPHUS Koch.

21. *O. ohioensis* Weed.
22. *O. pictus* Wood.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

WHILE the pursuit of pure science deals with the abstract, since nature has a physical basis the scientific man cannot neglect the practical. Like other men he must live, and he must have a career. In order to live he must have a reputation, or in other words he must, like other men, advertise his wares. Such is the practice of the worker in science, and happily such practice coincides with his direct line of work, which is the development of human knowledge. His pursuit advertises itself to the intelligent, so that the investigator need not go out of his way to become known if his work is good. And his reputation means a position and support for himself and his family.

It is not uncommon, however, to hear very exalted sentiments uttered by the enthusiastic devotee, to the effect that he cares nothing for the ordinary indications by which he may be known. He particularly disclaims the vulgar desire to give names, when it is fully within his right to do so, and he looks down with contempt on the man who thus affixes a trade-mark to the goods which he has himself produced. Now this is nothing but a mild form of hypocrisy, pleasing to him who entertains it and to the groundlings who know nothing of life, but it deceives no others. Let another step in and try to set up his shop in the "preserves" of these gentlemen, or let him try to attach his label to what he may discover therein, and human nature displays itself in vigorous forms. They are not so indifferent as they pretend to be.

We sometimes hear suggestions that the scientific field shall be divided. A shall do this, B that, and so on. Such propositions are most likely to emanate from some person who fears the industry or the ability of some one else, and desires to preëmpt a claim from which "depredators" shall be excluded. This also is human nature, but it is not the right kind. The defenders of such methods, however, assure us that it is in the true interest of science!

These remarks are *apropos* of a recommendation contained in the address before the Geological Section of the American Association for the Advancement of Science, of 1890, by its chairman, Prof. Jno. C. Branner, who is director of the Geological Survey of Arkansas. He recommends that the State Geological Surveys confine themselves to economical geological work, and leave the solution of all scientific problems to the United States Geological Survey. Perhaps Professor Branner intends to do this in the case of the survey which he directs, but if he does so we should consider him derelict in his duty to the people who have appointed him. We doubt, however, whether he will or can do so. As to other geological surveys, his proposition will be apt to provoke a smile. The scientific geologist, wherever located and however situated, will not probably confine himself to economic questions. Nor will the literature of geology be diminished as Prof. Branner professes to desire. If scientific geology is to be restricted

to the U. S. Geological Survey, and economic geology to the State Surveys, where do the Universities come in? and where private investigators working at their own expense?

It has been said that most men, if they had the opportunity, would be despots, and they would at the present time, as they have often in the past, plead some public good as their excuse. But in science most especially despotism is impossible. The investigator has the "inalienable right" to "life, liberty, and the pursuit of happiness" in the direction of scientific researches, and no man is competent to tell him what he shall do and what he shall not do. His *raison d'etre* is the quality of the work he does, and if his work is bad, it simply sinks out of sight. What good he does will be credited to him in the court of approval of the world of science, where everything stands on its merits, and local ambitions and political tactics are unknown.—C.

—WHILE there were a goodly number of entomological papers read at the recent Indianapolis meeting of the Society for the Promotion of Agricultural Science and the Entomological Club of the A. A. A. S., there was a notable scarcity of such papers before the Biological Section of the Association. This paucity was a subject of remark not only among entomologists, but workers in other lines as well. It is very desirable that in future years students of insect life furnish more papers of general biological interest, following in this respect the excellent example set by the botanists. While there is just now an urgent demand for the solution of many purely economic problems in entomology, and official workers are wisely devoting much of their time to these, they can scarcely afford to neglect entirely the biological side of their subject. Not only is there great need of the elucidation of insect life-histories, many of which are complex and difficult to determine, but there are hundreds of points where entomology touches the problems of general biology, and is able to aid greatly in their solution. No better illustration of this can be cited than the admirable researches of Professor and Mrs. Peckham upon the senses of wasps and sexual selection and mimicry in the spiders of the family Attidæ. Papers upon the classi-

fication and distribution of insects seem also of late to have become unfashionable at the association meetings, without sufficient reason. In the present craze for purely practical entomology it should be remembered that there is very little entomology that is not in some sense economic, and that if entomologists wish to attract to their ranks a desirable class of amateur students, they must show that in the world of insects there are other problems than those of spraying with the arsenites or fighting the codling moth.—W.

—THE electric execution law of New York State should be repealed pending the development of our knowledge on the subject. The course of an electric current in or on such a bad conductor as the human body is difficult to foresee, and in the case of Kemmler it seems to have disappointed the expectations of the designers of the apparatus. The current did not traverse the spinal cord as was intended, but followed the dorsal muscles, which were, according to the reports, completely roasted. What is then to prevent its taking a superficial direction on the head as well? The frequent statements which are made of men receiving shocks of higher power than that used in the execution of Kemmler confirms the belief that the direction of the current is an uncertain quantity in the problem. So long as this uncertainty remains, so long will electrical execution be a trifling with the subject, which is inexcusable. In the present state of our knowledge of the subject the law is a disgrace to the statute-book of the State of New York. Execution by hanging is not thought to be a painful manner of death, although the guillotine is probably less so.

We expect to have some comment on the subject, in a future number of the NATURALIST, by a well-known expert, who was present at the execution of Kemmler.

RECENT BOOKS AND PAMPHLETS.

ALLEN, H.—The Distribution of the Color-Marks of the Mammalia. Ext. Proc. Phila. Acad. Nat. Sci., Feb., 1888. From the author.

——Description of Two New Species of Bats, *Nyctinomus euryops* and *N. orthotis*. Ext. Proc. U. S. Nat. Mus., Vol. XII., pp. 635–640. From the Smithsonian Institution.

ALLEN, J. A.—Notes on a Collection of Mammals from Southern Mexico, with Descriptions of New Species of the Genera Sciurus, Tamias, and Sigmodon. Ext. Bull. Am. Mus. Nat. Hist., Vol. II., No. 3. From the author.

——On North American Ground Squirrels. Ext. Bull. Am. Mus. Nat. Hist. From the author.

Annual Report of the Canadian Institute, 1888–9.

Annales de la Société Entomologique de Belgique. Tome Trente Deuxième.

Annales de la Société Belge de Microscopie. Tome XII.

Annalen des K. K. Naturhistorischen Hofmuseums. Redigirt von Franz Ritter Von Hauer.

BECKER, G. F.—An Elementary Proof of the Earth's Rigidity. Reprint from the *Am. Jour. Sci.*, Vol. XXXIX., May, 1890.

BLACKMAR, F. W.—The History of Federal and State Aid to Higher Education in the United States. From the Bureau of Education.

BLYTT, A.—Additional Note to the Probable Cause of the Displacement of Beach-Lines. From the author.

BOETTGER, O.—Ueber die Leistungen in der Herpetologie Während des Jahres, 1886.

——Verzeichnis der von Hernn Stäatsrath O. Retowski auf seiner Reise von Konstantinopel nach Batum Gesammelten Reptilien und Batrachier. Sonderabdruck aus Bericht über die Senckenbergische Naturforschende Gesellschaft in Frankfort A. M., 1889. From the author.

BOLLMAN, C. H.—Notes on a Small Collection of Myriapods from the Bermuda Islands. Ext. Proc. Phila. Acad. Nat. Sci., 1889.

BONAPARTE, R.—Le Premier Etablissement des Néerlandais à Maurice.

——Le Golfe Huon. Note on the Lapps of Finmark. Le Fleuve Augusta. From the author.

BONAPARTE, C. J.—Civil Service Reform as a Moral Question. From the author.

BONNEY, T. G.—Notes on Two Traverses of the Crystalline Rocks of the Alps. Ext. *Quar. Jour. Geol. Sci.*, Feb., 1889. From the author.

BONWILL, W. G. A.—The Philosophy of Eating and Drinking from a Dental and Medical Standpoint. From the author.

BOULENGER, G. A.—A List of the Reptiles and Batrachians of Amoorland. Ext. *Ann. and Mag. Nat. Hist.*, Feb., 1890.

——Note on *Python curtus*. Ext. Proc. London Zool. Soc., Nov., 1889.

——On Some Specimens of Lizards in the Halle Zool. Mus.—Second Account of the Fishes Obtained by A. S. G. Jayakar, at Muscat, Arabia. Exts. Proc. London Zool. Soc., 1889. From the author.

BRAINARD, E., AND H. M. SEELEY.—The Calciferous Formations in the Champlain Valley. Ext. Bull. Geol. Soc. Am., Vol. I., pp. 501–516.

Bulletin of the U. S. Fish Commission, Vol. VII. From the Fish Commission.

Bulletin of the Washburn College Laboratory of Nat. Hist., Vol. II., No. 11.

Bulletin No. 4, Agri. Exp. Sta. of the Rhode Island State Agri. School.

BURMEISTER, H.—Bericht über Mastodon andium. Sitzungsb. K. Preuss. Akad. Wissenschaften, 1888.

CHAMBERLAIN, T. C.—Some Evidences Bearing on the Interval Between the Glacial Epochs. Ext. Bull. Geol. Soc. Am., Vol. I., pp. 469–480. From the author.

CHAUNCEY, H., DE.—Etude sur l'Origine des Basgares. Ext. du Bull. Soc. Geo., 1889. From the author.

CLARK, W. B.—On the Tertiary Deposits of the Cape Fear River Region. Ext. Bull. Geol. Soc. Am., Vol. I. From the author.

COOK, A. J.—Insecticides, Bulletin 58; Fowl Brood, Bulletin 61; The English Sparrow, Bulletin 62; Agricultural Station Michigan State Agricultural School. From the author.

CRAGIN, F. W.—Contributions to the Palæontology of the Plains. Bull. Washburn College Laboratory, Vol. II. From the author.

CROSBY, W. O.—Physical History of the Boston Basin. From the author.

DALL, W. H.—Preliminary Report on the Collection of Mollusca and Brachiopoda. Obtained in 1887-'88. Ext. Proc. U. S. Nat. Mus., Vol. XII. From the Smithsonian Institution.

——On Dynamic Influences of Evolution.

——On the Hinge of Pelecypods and its Development, with an Attempt toward a better Sub-division of the Group. Ext. *Am. Jour. of Sci.*, Vol. XXXVIII.

——A Preliminary Catalogue of the Shell-Bearing Marine Mollusks and Brachiopods of the S. E. Coast of the U. S. Bull. U. S. Nat. Mus. No. 37. From the author.

DILLER, J. S.—Sandstone Dykes. Bull. Geol. Soc. of America, Vol. I., pp. 411–442. From the author.

EDWARDS, H.—Bibliographical Catalogue of the Described Transformations of North American Lepidoptera. Bull. U. S. Nat. Mus. No. 35.

EYERMAN, J.—Bibliography of North American Vertebrate Paleontology for the Year 1889. Ext. from the *American Geologist*, April, 1890. From the author.

EIMER, C. H. T.—Organic Evolution. From MacMillan & Co.

HAECKEL, E.—Natürlichen Schopfungs-Geschichte.

——Report of the Deep-Sea Keratosa Collected by H. M. S. Challenger, 1873-'76. From the author.

HADDON, A. C.—On Two Species of Actiniæ from the Mergui Archipelago. Ext. *Journ. Linn. Soc.*, Vol. XXI.

HALSTED, B. D.—Some Fungus Diseases of the Cranberry. Bull. 64, New Jersey Agri. Coll. Exp. Station.

HANCOCK, J.—Description of a New Species of Datames. Read before Am. Philos Soc., April, 1887. From the author.

HENSHAW, S.—Bibliography to American Economic Entomology. From J. M. Rusk.

HOUGH, W.—Notes on Aboriginal Fire-Making. Ext. Proc. A. A. A. S., Vol. XXXVIII, 1889. From the author.

IRELAN, W.—Ninth Annual Report California Mining Bureau. From the author.

KIRSCH, P. H.—Notes on Fishes Obtained by Lieut. Carpenter in the Gila River. Ext. Proc. U. S. Nat. Mus., 1888. From the author.

KOEBELE, A.—Natural Enemies of the Fluted Scale. Bull. No. 21, U. S. Dept. Agri.

——Report of the Fluted Scale of the Orange, and its Natural Enemies in Australia, Bull. No. 21, U. S. Department of Agriculture. From J. M. Rusk.

FORBES, S. A.—Report on the Noxious and Beneficial Insects of the State of Illinois. 1887-'88.

FRAAS, E.—Die Labyrinthodonten der Schwabischen Trias. Separat-Abdruck aus Palaeontographica, XXXVI. Band. From the author.

RECENT LITERATURE.

Dall on Dynamic Influences in Evolution.[1]—In this interesting paper we find that Mr. Dall turns to mechanical influences of environment as an essential factor in evolution.

It is generally admitted, he says, that in natural selection we have a theory which accounts for the perpetuation of favorable, and the elimination, in the long run, of unfavorable variations in organic beings. It is equally admitted that the origin of variation is not accounted for by this theory. To round out our conception of the mode of evolution it is necessary that this deficiency should be supplied. It should also be supplemented by some conception of the mode by which variation is sustained in a given direction until it has reached a point of usefulness sufficiently marked to enable the selective process to operate.

He accepts the relation of the organism to its environment as the desired factor, and for this adopt the name of Dynamic Influences. He maintains that acquired characteristics are inherited. The organism suffers during its entire existence a continuous series of mechanical impacts, none the less real because invisible. Since individual organisms usually appear free to wander or remain quiescent, the idea that they are under constant stress does not ordinarily suggest itself, and to this fact he ascribes the slowness with which the dynamic element in evolution has received recognition. The characters developed in an organism in response to impacts are acquired, but that which is transmitted is a facility of response in the same line. This, under favorable conditions and a series of generations subjected to similar impacts, may promote and establish the physiological habit, which is the directive influence towards the development of the characters in question.

The dynamics of environment vary within comparatively narrow limits, when consistent with organic existence. On the other hand, owing to the narrowness of the limits, the dynamic variations to which organic forms are subjected become relatively more important. It is probable that no two organisms have ever been subjected to exactly the same dynamic influences during their development. Differences of impact necessarily imply differences of response, hence variation is inevitable. The origin of variation, therefore, presents no difficulties.

[1] Read before the Biological Society of Washington, March 8, 1890, by Wm. H. Dall.

The question is, How are the small necessary and admitted differences stimulated to develop into the obvious differences recognized by systematic biologists? To this he answers that the reactions of the organism against the physical forces and mechanical properties of its environment are abundantly sufficient, if we are granted a simple organism, with a tendency to grow, time for the operation of forces, and the principle of the survival of the fittest.

It is often assumed that the possibility of variation is equal in every direction. A consideration of the dynamic conditions of life shows that this is not the case. Under conditions which would permit it, resulting organic forms would be sub-spherical, and would have to pass their entire existence in constant rotation. The moment one of them came to rest, it would be subjected to unequal stresses. Light, gravity, nutrition, etc., would be unequally distributed, forcing an unequal growth and specialization of regions. Inequality established, locomotion, with attendant friction and resistance, would confirm the inequality. Organic matter, as such, is in no sense released from the servitude of matter to the operation of physical forces.

Mr. Dall divides the operation of biologic selection into two categories: 1st, That in which fitness and unfitness are determined by the perfection in adjustment of the individual to the mechanics of the environment; 2d, That in which intelligence becomes a factor. The latter includes sexual selection, mimicry, protective coloration, etc. It is not necessary that the organism which is modified should possess even consciousness; but one of the two parties to the modification must possess intelligence of a certain grade. It is probable that influences of the second category operate more rapidly and produce greater diversity in development than could have been expected from the working of purely physical forces.

If the dynamic evolutionist brings forward an hypothesis which explains the facts of nature without violence to sound reasoning, that hypothesis is entitled to respect and consideration until some better one is proposed, or until some vitiating error is detected in it. For the dynamic hypothesis only those characters can be considered which arise from permanent physiological reactions due to the impact of external forces. Mutilations rarely fall into this category, and are essentially sporadic. A pathologic incident may affect the progeny, but only in trifling numbers, and it is of no importance to the dynamic hypothesis whether it can be proven or not. The forces invoked by dynamic hypothesis, on the other hand, affect every individual of a race and every generation as long as the environment continues unchanged.

It seems to the writer that Mr. Dall has not given the full value to pathologic cases. These may result from unfavorable surroundings; or at the close of the natural life of a species or group, pathologic changes may be taken on, as clearly shown by Prof. Hyatt in fossil Cephalopods. In these cases, all the individuals of a race and successive generations in a given locality or geological horizon may be induced to take on features of a pathologic character, and form a degradational series of individuals, species, or genera.

In studies of the development of the hinge of Pelecypods, and the columellar plaits of Voluta, Mitra, and other Gastropods, Mr. Dall gives concrete examples of dynamical genesis. These appeal strongly in in favor of this hypothesis, on account of the simplicity of the problem as he presents it, and the complete way in which the facts illustrate the mechanical stresses to which the parts have been exposed.

Mr. Dall's paper suggests to me what I believe is a new way in which to consider natural selection in its relation to dynamic influences. In their mutual relation it is clear that natural selection is not a new force coming in where dynamic influences cease; but rather it comes as a corollary of dynamic influences. It is not a foreign force, acting in some other and special way; but it acts in harmony with, and as a natural outcome of dynamic influences. If dynamic forces tend to push a series of organisms in any given time of variation, some individuals will evidently be pushed further on that line of variation than other individuals, on account of greater plasticity or other causes. Those which have yielded most fully to the acting forces will be as a necessity more completely in harmony with the mechanical requirements of the environment; therefore they will be more likely to successfully propagate and hand down the modified features which fit them for the environment, and have been fitted on to them by the environment. That such individuals will propagate especially freely may be legitimately inferred from the well-known principle, that complete harmony with environment is one of the prime factors in the successful reproduction of animals and plants. Such especially well-fitted individuals are not exceptional and sporadic cases; they are in direct accord with the ascendant line of the series to which they belong, and would therefore be naturally selected because they have most completely filled the mechanical requirements of their environment. During successive generations individual advantages naturally selected on this principle will not tend to become merged and lost sight of in the general average; they will tend to elevate and bring into greater perfection of equilibrium the oncoming generations.

ROBERT T. JACKSON.

Poulton on the Colors of Animals.[1]—The meaning and uses ot animals are stated systematically in this monograph, a valuable addition to the literature of this department of natural history. The classification shows an intimate knowledge of the subject from personal observation and a wide acquaintance with the studies of others, whether embodied in occasional papers or the proceedings or transactions of various scientific societies. Mr. Poulton adopts the general title, "The Colors of Animals," in order to indicate the contents of this volume, although the majority of the examples are taken from insects, chiefly from a single order, the Lepidoptera.

In investigating the physical cause of animal colors, their production is conveniently grouped under two heads,—*pigmentary* and *structural.* The first includes, under a first head, colors caused by absorption, the effects varying with the chemical nature of the substance (pigment). The second head includes the colors produced in all other ways, the efficient cause being the structure of the substance rather than its chemical nature. No pause is made to discuss the details of the causes of color by absorption, except to mention the observance of vibrations of very different rates. The existence of vibrations of light above and below the visible series is proved in other ways, and reference is made to the conclusion reached by Sir John Lubbock ("The Senses of Animals") that it is certain that some animals can see vibrations which do not affect our eyes. The slowest vibrations that we can see produce the effect of red; the most rapid, the effect of violet; "while the intermediate vibrations cause the other well-known colors of the rainbow or the spectrum."

The white markings of animals are produced in various ways. The writer explains the snow-like appearance of white hairs and feathers by the number of minute bubbles of gas which are contained in their interstices. "Interference colors," due to thin films of air included between layers of horny consistence, are then treated with reference to their probable production of iridescent coloring. In some cases it is supposed that the chinks between the layers of tissue are kept open by films of liquid, producing the brilliant metallic appearance of many chrysalides. An interesting observation showed a brilliant golden beetle lost all its lustre after hibernating in captivity, but entirely regained it after drinking some water. After brief consideration of the colors due to diffraction and refraction (prismatic

[1] The Colors of Animals, their meaning and use, especially considered in the case of insects. By Edward Bagnall Poulton, M.A., F.R.S. With chromo-lithographic frontispiece and 66 figures in text. New York: D. Appleton & Co.

colors), the writer passes to the uses of colors, the chief object of this inquiry.

Mr. Poulton supports his own theory of the direct physiological value of the uses of color to animals by a large amount of experimental evidence brought together from many sources. Some interesting conclusions were brought forward by Lord Walsingham upon the predominance of dark varieties of insects and white varieties of birds and mammals in northern latitudes. The most widespread use of color appears to be its assistance to an animal in escaping from enemies and in capturing prey; the former is called Protective, the latter Aggressive Resemblance.

The general recapitulation of the colors of animals gives (1) non-significant colors; (2) significant colors, which are subdivided into colors of direct physiological value, protective and aggressive resemblance, protective and aggressive mimicry, warning colors, and colors displayed in courtship. Mimicry is an important section of special resemblance; when an animal gains advantage by a superficial resemblance to some other species which is well known and dreaded, because of some unpleasant quality, it is called protective mimicry; when, however, an animal resembles another so as to be able to injure the latter, the mimicry is considered aggressive.

Warning colors are advantageous to enable an animal to escape experimental "tasting," for, when it possesses an unpleasant attribute, it is well to advertise the fact as publicly as possible by conspicuous patterns and strongly-marked colors. The colors and markings of butterflies and moths often represent some familiar appearance of withered or decayed leaves. A detail of great interest is added to the disguise by the semblance of a small hole to indicate piercing by insect larvæ. Mr. Poulton allows himself to say that *perhaps* the most perfect concealment attained by any butterfly is seen in the genus Kallima, described by Wallace. This resembles in outline a withered and somewhat shriveled leaf, when at rest; along the supposed leaf runs a distinct mark like a mid-rib, with oblique veining on either side.

The color and markings of birds' eggs are supposed to be of high protective value as observed in their natural surroundings.

Some remarkable instances of rapid adjustment are cited in the chapter on "Variable Protective Resemblance in Vertebrata," etc. Fishermen know that trout caught in a sandy-bottomed stream are light colored, while those caught in a muddy stream are dark. "It is also well known that the same fish will soon change in color when it passes from one kind of background to the other." Other animals possess the

same power of adjusting their color to correspond with a peculiar environment. It is well known that the common frog can change its tints to a considerable extent. In asserting that the changes of color depend upon the eye, and blind animals cannot vary their color protectively, Mr. Poulton supports his position by the results of the investigations of Lister, Brücke, and Pouchet on the physiological mechanism of these rapid changes of color. The change of color in Arctic mammals is a difficult problem. The seasonal change of color in birds is referred partly to aid in concealment, and also to loss of susceptibility to cold supposed to result from the white winter coat.

A never-failing interest attaches to the subject of "Warning Colors." The history of the discovery of warning colors in caterpillars is quoted with many examples, showing that the education of enemies is assisted by the fact that "warning colors" and patterns often resemble each other, and there is abundant evidence to show that insect-eating animals learn by experience. By a natural transition the writer passes to a consideration of colors and markings which direct the attention of an enemy to some non-vital part, and which are not attended by unpleasant qualities. An inquiry of great charm directs attention to the importance of recognition markings, and the principles as set forth by Messrs. Wallace and Tylor. A familiar illustration will occur in the white upturned tail of the rabbit, by which the young and inexperienced are shown the way to the burrow by the individuals in advance of the expedition.

In discussing the mimetic appearances of unprotected classes, it is made plain that the term mimicry is used for convenience, for the mimicking is of course unconscious, so that the use of the word is not likely to mislead.

Mr. Poulton believes that the habits of Bower Birds are evidence for the existence of strongly-marked æsthetic taste in birds.

In conclusion, Mr. Poulton brings together the results arrived at by investigations, and shows their relation to each other in a system of classification. A detailed table gives the colors of animals classified according to their uses, one or more examples accompanying the definition of the terms, not those used in the body of the book, which were better adapted to illustrate the meaning. The writer believes that existing knowledge is well represented by the provisional arrangement suggested by this table. The book is thoroughly illustrated; the frontispiece is a chromo-lithographic plate exhibiting remarkable instances of mimicry in South African butterflies. Mr. Poulton's scientific work has been inspired by his firm resolve to support, in however

small a degree, and to illustrate by new examples, the great principles of biology enunciated by Darwin, and in especial "the preëminent principle" of natural selection.

To the above general description of Mr. Poulton's work, which we take, with some alterations, from a contemporary, we add the following comments:

The author remarks in his preface: "It is common enough nowadays to hear of new hypotheses which are believed (by their inventors) to explain the fact of evolution. These hypotheses are as destructive of one another as they are supposed to be of natural selection, *which remains as the one solid foundation upon which evolution rests*."[1] As this book is a conspicuous example of the type of thought which regards natural selection as the cause of evolution, we give some attention to its method of treatment of this interesting question. This treatment consists, as in the case of other post-Darwinians, as Wallace, Lankester, etc., in a failure to consider the problem of the origin of the variations between which there is a struggle for existence, and which are therefore the materials of natural selection. It would appear that these scientists are generally insensible to the fact that there is any such question. I say generally, for occasionally each of them slips into an attempt to assign some physical or mechanical cause to a variation. The question will not down, as is illustrated in several places in Mr. Poulton's book. One which cannot be avoided is the question of the origin of significant colors, where our author, in one short sentence, "gives away" the whole question. On page 13 he remarks: "All animal color must have been originally non-significant, for although selective agencies have found manifold uses for color, this fact can never have accounted for its first appearance." The prompt avoidance of the question of origin, however, immediately follows, as he goes on to say: "It has, however, been shown that this first appearance presents no difficulty, for color is always liable to occur as an incidental result." We should like to know something about the origin of color and its distribution in animals, but of this we find scarcely a hint in the entire book. On the other hand, the book consists of full and rich illustrations of the utility of color shades and patterns after they have been produced.

The question of mimicry is fully illustrated and discussed, and the conclusion is reached that its existence can be fully explained by natural selection. The real question of the origin of mimetic coloration is not considered, except in a foot-note on page 224. The

[1] The italics are our own.

author quotes Mr. Skertchly as endeavoring to explain the origin of such coloration as follows: "This theory 'presupposes (*a*) that danger is universal; (*b*) that some butterflies escape danger by secreting a nauseous fluid; (*c*) that other butterflies ***noticed this immunity***; (*d*) ***that they copied it***.' The opinion expressed in the words I have italicised will hardly be accepted by a single naturalist. I imagine that even the American Neo-Lamarckians do not follow their founder so far as to believe that the volition of an animal could account for all the details of mimetic resemblance."

Both Mr. Skertchly and his critic illustrate the misunderstanding which may arise from a neglect of the physiology of the origin of variations. Yet the great value of the present work consists in the fact that it is a mine of information for the investigator in this direction. Thus, on page 113 and afterwards are narrated the author's remarkable experiments on the imitation by the pupas of butterflies of the colors of the bodies to which they are attached; experiments already commenced by Mr. W. W. Wood, Prof. Meldola, Mrs. McE. Barber, Mr. Mansel Neale, and others. Green, yellow, and reddish-brown surroundings were closely imitated by the colors of pupas of the same species placed in proximity to them. Mr. Poulton found with pupas of *Vanessa urticæ*, which have normally some gilt spots, that when they were placed within black surroundings they were, as a rule, extremely dark, with only the smallest traces, and often no trace at all, of the golden spots which are so conspicuous in the lighter forms. He then tried white surroundings on 150 chrysalides. In this case "not only was the black coloring matter, as a rule, absent, so that the pupas was light-colored, but there was often an immense development of the golden spots, so that in many cases the whole surface of the pupas glittered with an apparent metallic lustre." A gilt background was then employed, with the result that a much higher percentage of gilded chrysalides, and still more remarkable individual instances, were obtained.

That these results are due to the direct influence of the light reflected from the surrounding surfaces on the body of the pupas seems extremely probable. The analogy, suggested by Wood, to photographic process, is probably correctly rejected by Poulton as an explanation, though that some analogous process is at work seems very probable. The fact that where the color when once produced cannot be changed by exposure to another color, urged by Poulton as conclusively disproving Wood's theory, has no such value, since the process is one which is coincident with growth, and cannot be

seconded any more than a sensitive plate once used can receive a second photographic impression; nor is it necessary with Mr. Skertchly to suppose that the pupa "notices" the color of its surroundings, though we do not know whether it is conscious of them or not. I have myself suggested[3] that mimetic analogy is to be explained by the impression produced on the reproductive elements by a sense impression, as in the cases of "maternal impressions," of which some real cases exist. Nor does such a theory require that any "volition" be present, such as Mr. Poulton ascribed to "the founder" of American Neo-Lamarckianism. Such a hypothesis is confirmed by a fact mentioned by Mr. Poulton on page 238. He says: "This example enforces a conclusion arrived at by the study of mimetic butterflies in all parts of the world,—that the females are far more liable to assume this method of defense than the males. Thus Mr. Wallace found that the eastern Morphidæ and the special group of swallow-tails were only mimicked by the females of other swallow-tails; and similar facts have been observed in America." The male young have developed beyond the effects of the impression, while the female young have not.—E. D. Cope.

Billet on the Life History of Bacteria.[4]—In addition to elborate laboratory work with the *Cladothrix dichotoma*, *Bacterium balbianii*, *Bacterium osteophilum*, and *Bacterium parasiticum*, following them step by step through the filamentous, dissociated, entangled, and zooglœic states, and giving conclusive proof that the present classification of microbes is erroneous, this work has a bibliographic index of 662 references, including the names of over four hundred authors.

The author does much to clear up the history of this subject, and also points out clearly that more attention has been paid to the effects upon the animal economy than to the morphology. He calls attention to the fact that the "Cohn school" declares for one unchangeable form, and that Zopf merely specifies types according to the forms.

Billet very properly claims that one form may be derived from another, and cites that Ray Lankester first recorded that the forms were not sufficient. for classification, the latter being confirmed by Cienkowski. Billet shows that the bacterium (the short rod form) is able to take on sufficient length to represent the bacillus; that a number of these can form chains; and that the vibrio is found in different media to change into the spirillum. He follows the cladothrix through

[3] Proceedings American Philosophical Society, 1871, p. 261. Origin of the Fittest, p. 213.

[4] Contribution a l'étude de la Morphologie et du Développement des Bacteriacées, par Albert Billet, Docteur en Medecine, Medecin-Major, 2 Classe.—*Bulletin Scientifique de la France et de la Belgique*, 1890.

all the known forms of microbes, and shows that these microorganisms have different powers of receiving stains according to their ages.

If he be correct in the foregoing statements, many genera will be done away with. It is very interesting to follow his experiments showing the growth and development of one form into another, noting his methods of detecting the cells, etc., which methods show much labor and careful manipulation.

In treating of the typhoid germ he claims that it is not chromogenic. The work shows a marked difference in the various forms of the *Bacterium balbianii* (found in marine algæ), and the *Micrococcus prodigiosus* and the *Bacillus violaceus*, and follows them through the filamentous, dissociated, entangled, and zooglœic forms; it shows that they can live in air and may resist 100° C., that they assume an orange color on the surface of certain solid media, and that they undergo endogenous spore formation. It also shows that the *Bacterium osteophilium* is mostly found in macerated human bone surrounded with yellow fat, and that this also undergoes endogenous spore formation. He shows an evolution cycle, divided into the filamentous, dissociated, entangled, and zooglœic states. These different states correspond to a morphological grouping, and are due to the nutritive media, temperature, pressure, amount of oxygen, etc. Consequently, many morphological forms represent the same species. The zooglœic state merely represents a state of preservation. As has been said, the forms cannot determine the genera; and as we do not know at present the principal genera, we must not attempt to classify them.

It will be seen that Billet is working in the right direction to reduce bacteriology to an exact science.—S. G. Dixon.

Corals and Coral Islands. By James D. Dana.—About a half-century ago two exploring expeditions were almost simultaneously circumnavigating the globe; one under the command of Captain (afterwards Admiral) Fitzroy of the English Navy, the other under the command of Lieutenant (afterwards Admiral) Wilkes of the United States Navy. These two expeditions are chiefly memorable for the work of two brilliant young naturalists by whom respectively they were accompanied. In the English expedition went a recent graduate of Cambridge, Charles Darwin, whose dust now rests in Westminster Abbey near to that of Sir Isaac Newton, and whose discovery of natural selection—the law of gravitation of organic nature—makes his name an epoch-making one in science since that of Newton. In the American expedition went a recent graduate of Yale, who still lives, full of years and honors, his eye not dim and his natural force not abated, facile princeps of American geologists, James D. Dana. Among

the results of those voyages, the most important (excepting, perhaps, the influence of the experiences of travel upon the growing minds of the great naturalists themselves) was the theory of the origin of barrier reefs and atolls, independently developed by Darwin in the study of the coral formations of the Indian Ocean, and by Dana in the study of those of the Pacific.

The problem of barrier reefs and atolls may be briefly stated. The reef-forming corals grow only in shallow water, seldom, if ever, reaching a depth of much more than one hundred feet. Their skeletons are broken by the waves, and their comminuted fragments consolidated into the reef rock. A belt of reef is thus naturally formed immediately adjoining the shore of a continent or island, or separated from the shore by a shallow channel, having a width of a mile, more or less. Such a channel is very apt to exist, since the water immediately in contact with the shore is apt to be too impure for the luxuriant growth of corals, while the conditions are most favorable for such growth on the outer margin of the reef. Such a reef is called a fringing reef, and its formation presents no perplexing problems. But the case is very different with the barrier reefs, which are separated from the shore of the continents which they border, or of the islands which they surround, by a deep channel, ten, twenty, one hundred, or more miles in width; and with the atolls, which are more or less irregular rings of reef rock, entire or broken by channels, standing out in mid-ocean away from any land, and enclosing lagoons, which are sometimes small and shallow, but which sometimes have a diameter of scores of miles and a depth much exceeding the limit of coral growth. On the outside of both barrier reefs and atolls the bottom generally slopes off pretty rapidly into truly oceanic depths.

The solution of the problem was given by Darwin and Dana in a theory which may be expressed in one word,—subsidence. Darwin had the priority in the formulation and publication of his views, and the theory is most commonly called by his name; but Dana's work was equally independent, and he was able to illustrate the theory with a much more extensive series of observations than Darwin had the opportunity to make. It seems, therefore, most just to link together the two illustrious names, and to call the theory the Darwin-Dana theory. Let the earth's crust in a region of coral reefs undergo a subsidence not more rapid than the rate of coral growth, and fringing reefs will obviously be converted into barrier reefs. Since the corals always grow most rapidly at the outer margin of the reef grounds, the inevitable effect of subsidence will be the widening and deepening of the channel

between the reef and the shore; and this is exactly what is required to transform a fringing into a barrier reef. If the reef was formed around an island, continued subsidence will suffice to convert the barrier reef into an atoll, the original island disappearing beneath the waters of the lagoon. Since the outer wall of the reef, though somewhat steep, is never precipitous, subsidence still continued after the formation of an atoll must diminish the size of the atoll and tend to obliterate the lagoon. The last stage of a coral island disappearing by continued subsidence is therefore a mere dot of coral rock.

The theory, in its charming simplicity, reminds one of Columbus's egg. It accounts for the facts with a marvellous perfection. And the correlation which it traces between the formation of those

"Summer isles of Eden lying in dark purple spheres of sea,"

and the vast crustal movements involved in continental changes of level in late Tertiary and Quaternary times, opens one of those glimpses of the unity of nature which give to scientific speculation a poetic sublimity. The Darwin-Dana theory was immediately and well-nigh universally accepted. Probably the first thought of almost every geologist, when the theory was announced, was, "Why did I not think of that myself?"

The subsidence theory, however, has had a rather curious history. After an undisputed reign of a third of a century, its title to the throne has been recently questioned, and, in the judgment of some of the ablest geologists, its days are numbered. The Duke of Argyll, who often (as King James said of Lord Bacon) "writes of learning like a Lord Chancellor," has made the assumption of the certain falsity of the subsidence theory the basis of a wholesale charge against the morality of scientific men, alleging that the majority of geologists have formed a "conspiracy of silence" to suppress the new views, in order to maintain before the public the infallibility of the idolized Darwin. It is, then, with a special interest that we turn, in this new edition of Dana's classical work, to the pages in which he deals with the recent discussion of the subject, and, after the mature deliberation of a half-century, defends the theory whose discovery was one of the earliest of his great achievements.

It is undoubtedly true that both barrier reefs and atolls may be formed without subsidence. If the water off the shore of a continent or island deepens very gradually, the water near the shore line may be too impure for coral growth, and the favorable conditions for such growth may be only attained at a distance of several miles from land.

In such situations the primary condition of the reefs would be that of barrier reefs (though differing from most barrier reefs in not sloping off rapidly into very deep water). The reefs of Florida are probably examples of this sort. Moreover, it was long since recognized by Chamisso, that, if the summit of a submarine volcano (or a shoal of any origin whatever) should be within the hundred-foot limit, the coral formations thereon would naturally assume the atoll form—a ring of reef encircling a lagoon—as the result simply of the more luxuriant growth of the corals on the outside than in the middle of the reef grounds. Murray, in his theory of atolls, in addition to the more luxuriant growth of corals on the outside, calls in the solvent action of the sea-water in the middle of the reef grounds in explanation of the lagoon,—an action whose importance he seems greatly to overrate.

A strong objection to Chamisso's theory of the origin of atolls has been found in the amount of coincidence which it requires. All atolls must represent submarine volcanoes (since no other shoals are likely to occur in mid-ocean), rising to within a hundred feet of the sea-level. The occurrence of so many independent volcanoes attaining so nearly the same altitude appears improbable. Murray meets this argument with the suggestion that forces are in action which tend to reduce all oceanic volcanoes to a uniform altitude, since rain, streams, and ocean waves tend to degrade to sea-level all peaks that rise above that level, while deposits of skeletons of pelagic life tend to raise the level of shoals which are yet too deep for coral growth. An island of any height could of course be leveled in time by the combined effects of subærial and marine denudation; and, as it is not unlikely that volcanic islands may have been formed in various geological periods, it is conceivable that scores or even hundreds of oceanic volcanoes, originally of various heights, might all exist to-day in the condition of shoals. But it is certain that wave-action could never degrade an island much below the water-level. The formation of atolls with deep lagoons, on the basis of volcanic cones truncated by wave-action, would seem impossible without subsidence. The depth of the lagoons, which is generally considerable in the larger atolls, and which sometimes amounts to more than three times the extreme depth of coral growth, seems, in fact, a conclusive argument for the subsidence theory. In commenting on the theory of Murray, which proposes to account for the foundation of coral islands by the accumulation of the remains of pelagic life, and to account for deep lagoons by the solvent action of the water, Darwin is reported to have said to a friend, not long before his death, that he could not understand how the water could possess so great solvent

power in the lagoon of an atoll, and so little solvent power anywhere else. We find ourselves in very much the same state of mind.

The distribution of coral formations in the Pacific accords exceedingly well with the Darwin-Dana theory. South and west of the Sandwich Islands there lies a large area nearly or quite destitute of islands of any kind. Passing southward and westward from this area—the area of maximum subsidence, according to the theory—we traverse zones characterized respectively (though with much local irregularity, as might be expected) by the predominance of small atolls and lagoonless islands, of large atolls with broad and deep lagoons, and of high islands encircled by barrier reefs, reaching at last an apparent limit to that area of subsidence in the fringing reefs of New Hebrides and the Solomon Islands.

Dana has pointed out a very interesting evidence of subsidence in the dissected form of the coast-line of the high islands encircled by barrier reefs,—narrow ridges radiating outward in "spider-leg" fashion between deep bays. A deeply-dissected coast-line, on continent or island, is rightly regarded as evidence of subsidence, since valley-making is the characteristic work of rivers or glaciers.

The limits of this article allow only a mention of the blocks of limestone on the submarine slope of Tahiti far below the reach of wave-action, and the discovery of coral rock hundreds of feet below the sea-level in the artesian borings at Honolulu, rightly regarded by Dana as evidences of subsidence.

We are inclined to find a confirmation of the Darwin-Dana theory in a consideration which many will regard as too speculative to have any weight. Although there are some exceptions, Darwin's generalization appears, on the whole, to be well established, that areas of barrier reefs and atolls are destitute of active volcanoes, while active volcanoes are found in areas of fringing reefs. If we adopt the view that the interior of the earth, though solid, is mostly in a state which might be called potential liquidity, the relations of temperature and pressure everywhere, beneath a thin, cold crust, being such that the slightest local diminution of pressure will allow extensive liquefaction,—a theory which seems perhaps most satisfactorily to harmonize the apparently conflicting indications of geological and physical evidence bearing on the subject,—it seems probable that the fire-lakes from which volcanoes are fed may be developed generally in areas of local elevation and consequent local diminution of pressure. If, then, the presence of barriers and atolls may be accepted as a mark of regions undergoing subsidence, in distinction from regions stationary or undergoing elevation,

Darwin's generalization would be seen to be not a mere coincidence, but a dynamical law.

We believe, in view of all the evidence brought forward in recent discussion, that it is altogether probable that extensive subsidences of the ocean's bed have taken place in Tertiary and Quaternary times, and that the majority of barriers and atolls are the result of such subsidence, though conceding that both barriers and atolls may be formed without subsidence.

We have devoted most of this review to the examination of the theory of barriers and atolls, in view of the interest which recent discussion has aroused. The book before us is, however, by no means a controversial work, nor is it chiefly occupied with the presentation of the Darwin-Dana theory. On the contrary, in a remarkably many-sided way, Professor Dana has given us all phases of the subject: the structure, physiology, and taxonomy of the coral animals; the mode of formation of reefs and islands; the far-reaching geological inferences which the facts suggest; the fantastic beauty of those gem-like islands; and, in sad contrast, the lack of the essential conditions of an indigenous or self-supporting civilization,—

> "Where every prospect pleases,
> And only man is vile."

The professional geologist will turn to the book for the latest and most matured views of one preëminently entitled to speak with authority. The student will find in it a well-digested encyclopedic work of reference. The general reader will follow with delight the steps of one who, with a love of nature so pure and childlike,

> "—— Wandered where the dreamy palm
> Murmured above the sleeping wave;
> And through the water clear and calm
> Looked down into the coral cave."

In regard to the externals of the book, it is enough to say that the publishers have got it up in a style worthy of the contents. The book is richly illustrated. In this edition several new maps are added, and a few beautiful colored plates of corals and sea-anemones.—WM. NORTH RICE, in *New Publications.*

General Notes.

GEOGRAPHY AND TRAVEL.

Honduras.—The geography of Honduras is too well known to be here treated in a detailed manner. Its territory stretches from north latitude 13 degrees 10 minutes to 16 degrees, and in west longitude between 83 degrees and 89 degrees 45 minutes.

Honduras contains 46,000 square miles, with a population of about 450,000. Of these we may reckon 35,000 as belonging to the white race; the remainder is composed mainly of Indians, Caribs, and mixtures.

The country is of a very mountainous character. A series of large streams drain Honduras, mainly toward the north and south. On the Pacific slope of the Cordilleras we have two main streams, the Rio Choluteca and Rio Goascoran, both entering the Gulf of Fonseca. The north coast is better supplied with streams. We encounter the rivers Cuyamee, Chamelican, Rio Ulna, Rio Caballo, Rio Caymanes, Rio Patook, and a number of others which, though large enough to float canoes, are not of sufficient importance to be mentioned in this general geographical sketch of Honduras. The rivers Ulna and Patook, which have their sources far in the interior near Comayagua and Tegucigalpa, are most important for navigation. Although at present scarcely navigated except with small boats, they might be with little expense, made navigable for river steamboats with light draft. These two rivers traverse one of the richest territories of Honduras, covered with a luxuriant growth of valuable wood, well adapted for raising coffee, sugar cane, cocoanuts, cocoa, cotton, and a great number of agricultural products. The mountains are traversed by lodes of gold and silver ore; also copper, lead, zinc, mercury, and coal occur; and yet the whole district is entirely undeveloped in spite of the navigable rivers Ulna and Patook, which connect the rich interior with the Atlantic ocean.

In a northeasterly direction we have the Rio Segovia, entering the Atlantic at the Cape Gracias a Dias. This river forms for hundreds of miles the boundary between the Mosquito territory of Honduras and Nicaragua. Though one of the largest rivers of Honduras, its course, as well as the territory through which it passes, is nearly unknown. The banks of these rivers are inhabited by the tribes of the Payas Indians, who have not only kept their independence, but also their seclusion from the outside world.

The language spoken in Honduras is principally Spanish. In the territories inhabited by the Mayas and Mosquito Indians various dialects of the Maya idiom are encountered.

Let me commence just here a description of our journey, starting from Panama.

A large coasting-steamer has, after a voyage of seven days, safely transferred us from old Panama to the fine and magnificent bay of Fonseca.

Already accustomed to the gigantic and picturesque display of the Cordilleras on the Pacific slope, we find in the bay of Fonseca, united in the supreme works of Nature, majestic greatness and idylic beauties. A large sheet of blue water of 120 square miles extends before our eyes. From its smooth surface rise, in most variegated forms, volcanic islands; some covered with tropical vegetation, others as barren and torn as if only formed a short time ago in the wild contest of fire and water.

These picturesque groups of islands are dominated by still larger cone-shaped mountains. We see afar the volcano de San Miguel, its head crowned with black rounded clouds of smoke, which are heaped upon each other; closer to us is the famous Cosequina, and in our immediate neighborhood is the volcano de Sagate, now inactive, a ruin of a mountain, which on its ragged and torn surface, even to the present time, is bearing the marks of a terrible struggle between it and volcanic agency. The features of death imprinted upon its surface seem to have made the whole mountain destitute of animal and vegetable life. Our native guide pronounces the mountain to be haunted by the "evil spirit."

We cannot but show a badly-concealed smile while listening to a sad tale of a still sadder mountain ghost.

Our offended guide only very reluctantly consents to our proposal to hunt for the foe. We soon encountered a number of skeletons of animals, and with them his traditional bad spirit in the form of carbonic dioxyd or carbonic acid, which exudes from the interior through the open crevices of the mountain, and which proves fatal to animal life. This is the "evil spirit" the simple natives talked of.

Nearly opposite the now inactive volcano Sagate is the flourishing island of Tigre, about twenty-two miles in circumference, which forms the base of the cone-shaped, inactive volcano Tigre, about 3500 feet high, abundantly covered with vegetation. At its foot is the port and town of Amapala.

We embark, and though we are strangers to the Hondurian people, we receive at nearly every step marked attention and proofs of Central American politeness.

Our kind host is not satisfied with offering us all that his house affords. He asks us to accept with his "a la disposicion de Vm," anything that he imagines has attracted our attention. I have no doubt our host means to be sincere (?) in his *offer*, but we would most likely seriously grieve him in accepting his numerous extravagant tokens of hospitality. Most of the Hondurians are of good and noble character, hospitable and charitable toward sick people, as I myself once had an opportunity of learning. On my journey from the interior towards the north coast I was attacked with fever, when thirty miles from the nearest habitation.

A ride of thirty miles a day in a country which has no roads, but only paths over high mountains and thickly overgrown plains, is a fatiguing task, and more so for one who is sick. I arrived late at a house, asked permission to enter, which was cheerfully granted me, and during a severe illness of seven days I was carefully nursed and provided with native remedies for my complaint.

Leaving the hut and its charitable and hospitable inhabitants, I asked permission to offer, beside my thanks, a small amount of money to remunerate them for their expenses and time, but scarcely could induce them to accept money. "Senor Estrangero" (stranger), said the old Indian woman, "we have given you shelter because you have needed it; we have nursed you to restore your health, but not to have the holy duty of charity made a profitable business to us. We must refuse your money, and are contented with your thanks." A woman who takes care of a sick person is called "mujer de Dios" (woman of God). If she needs herbs or food for her patient, any one will furnish them to her, and the few words, "Soy mujer de Dios" (I am a woman of God), are more powerful in securing aid for her than money.

Life and property are well secured in Honduras. Speaking from my own experience, I never had the least difficulty in my travels through this country, and although I carried sometimes a considerable sum of money, I never was attacked or robbed. On the road I often met men carrying a large amount of crude silver and gold from the mines towards the capital and the coasts. Frequently they were not even armed, and, nevertheless, I never heard that the carrier was plundered or had absconded. The Hondurian is, as a rule, indolent, as a result of the abundant products of nature, which furnish him all he needs

with the least amount of work. But once aroused from his lethargy, he will endure harder work and more fatigue than his northern brother. Peaceable by nature and most anxious for the preservation of his health, he will, incited by the furies of war, become desperate and even cruel. His life, once so dear and precious, now becomes valueless to him. He prefers to die, face to the foe, than to retreat before a powerful enemy who attempts to invade his beloved country.

History has thrown immortal glory upon those 300 men of Sparta who fell in the defence of their country. In Honduras no records tell the story of the soldiers, buried or left where they died, far out in the wilderness. Only a number of heaps of stones with some weather-worn crosses indicate the places of rest of those brave fellows who died with the cry of "viva la patria," and no Hondurian will pass these monuments without uncovering his head and adding a new stone to his memory.

The Hondurians pass their leisure hours in gay and social entertainments, in which guitar, song, and dance form the main part. They enjoy themselves to the utmost, but the frank expression of joy is half concealed under the grave Spanish features, which seldom reproduce the sentiments of joy and sorrow.

Gambling is frequently met with in Honduras, and this vice extends to nearly all classes of society. Their national sport is equestrianism, in which they are very expert. Of their national games, we may mention hunting, bull-fighting, and cock-fighting.

The women of Honduras are superior to the men. They have the good qualities of the latter, but are more industrious, more peaceable and charitable.

Having thus given you some of the main features of the Hondurian character, we proceed with our journey from Amapala to the village of La Brea.

A small boat, with a good breeze, is rapidly ploughing its road through the bay of Fonseca, and within four hours we reach the estuaries of the Rio Choluteca which empties by seven mouths into the Pacific Ocean. We enter one of the river branches, and, pulling up through tropical forests with thick undergrowth, we reach in two hours more the village of La Brea. On our journey up the broad river our boat at times became entangled in the roots and branches of the mangrove trees, which abound on this coast.

The tree is, at present, not utilized by man, although it might become an important article of commerce on account of its containing tannin. But nature has already made use of the mangrove tree. Its

roots and branches form a kind of breastwork against the dashing waves of the sea, and not only prevent the destruction of the shores by the erosive action of the waters, but retain in the network of their roots a considerable quantity of organic and inorganic debris, carried from the interior toward the sea. As soon as the roots have accumulated enough material to form firm land, the tree dies, and new sprouts spring forth again toward the sea to recommence the same process. I have no hesitation in saying that the whole of the low diluvial and aluvial coast land on the Pacific and Atlantic shores of Honduras was formed by the aid of mangrove trees, and that the same process of formation of new land will continue as long as there are mangrove trees, and debris carried away from the interior towards the coast.

The phenomenon of a continuous process of land formation on Central American shores is certainly interesting in the *fact* itself; but more so if viewed in regard to its *causes*. We have vegetable life in mechanical and chemical co-operation with meteorology, and it results in building up new formations from mineral substances, which had once appeared in different combination and positions in the geological and topographical structure of Honduras. Nature's laws of economy thus appear before us. We see a constant change of forms in all organic and inorganic matter, but the amount of material remains stable, as well as the laws of nature.

I beg to continue with a few remarks on the natural drainage of Honduras, be it of its water or of its debris, which together must materially influence the topographical aspect of the country. The desire and intention of nature to equalize height and depth is strikingly manifested in Honduras. We would, perhaps, suppose that after the struggle of the palæozoic Hondurian continent with the tertiary epoch and its eruptions of rhyolites, basalts, and lavas, an epoch of rest, a time of peace, would follow. Our supposition is correct in one respect. The periods of continuous eruptions are over, and the undulations of the disturbed crust have ceased, with the exception of a few sudden earthquakes, which are mainly felt where large sheets of water lie above mineral substances undergoing decomposition. Meteoric events, besides, seem to stand in some direct relation with earthquakes, as we know that the latter principally occur after the rainy season, and with a low state of barometer.

Although earthquakes may cause some local disturbances, yet they are too insignificant to produce a material alteration in the character of the scenery. But at the present time a continuous change in the topo-

graphical features of Honduras is nevertheless in operation, perhaps not noticed in the short time of days, but the more strikingly in the long periods of geological ages.

These alterations of the form of mountains and valleys we may mainly attribute to meteoric agency, in particular to rainfalls, and to the lithological character of a great portion of the material of which the Hondurian mountains are composed. The rocks on the Pacific slope consist principally of rhyolite, andesite, volcanic, tufas, and augitic lavas, most of which are not apt to resist the erosive and destroying action of water and air, not only on account of friable structure, but of the want of stability in their chemical constituents. We see those mineral aggregations undergo metamorphic alterations, and thus we have, instead of the original finely crystalized hard material, accumulations of soft tufas, or common clay. A material thus altered cannot preserve its original outlines, and cannot resist the ponderous waves of water sweeping during the rainy seasons from the heights of the interior towards the level of the oceans.

There are no other meteorological records in existence which might inform us of former and ancient events in Honduras, but those which were registered by nature herself in form of striking alterations, to which the early topographical aspect of that country has been subjected during a series of epochs up to the present time.

The changes in the topography of Honduras, and principally those produced since the elapse of the tertiary period, as already mentioned, are caused by heavy falls of rain, the erosive action of which the half-decomposed rock-material could not resist; it became detached and stored away in the depths of the valleys or on the levels of the sea-shores, thus producing, after the long periods of geological ages, material alterations and changes on the surface.

At the present time the amount of water in the rivers is in direct proportion to rainfalls, and without much doubt has been always depending upon this phenomenon. We are, therefore, justified in calling those huge mineral accumulations of the diluvial and alluvial age, on the coastlands or in the interior, *direct data* and records in regard to the quantity of *former rainfalls*. In order to receive an adequate idea of the quantity of debris already used by nature for her process of building new plains, let us examine some features of the erosive action of water on the mountains themselves.

We traverse the plain between La Brea and Gnoscoran, and on entering the latter village we come upon tertiary grounds. A series of isolated volcanic mountains rise before us. Some are of the shape of a

perfect cone; others are long but narrow, their tops presenting frequently from 3 to 5 peaks or cones which are arranged in linear succession. This peculiar shape is not caused by erosion, nor can it be a mere freak of nature, as this mountain-form presents itself too often to us in our excursions through Honduras. It must be based upon similar physical and mechanical laws which we find effect the columnar, pentagonal, or hexagonal structure of a great series of volcanic rocks.

We continue our journey, and encounter, towards the interior, in a north-easterly direction from Gnoscoran, the interesting crater-ranges or crater-valleys in the neighborhood of the village of Langli. From there we proceed to the mountains of Curraren.

The official topographical map of Honduras, made in 1860, which is usually considered the most correct, proves useless to us as soon as we enter the interior mountain wilderness of Honduras. It is impossible to locate ourselves by aid of the map, as even the principal mountains and villages or towns have been too incorrectly determined in regard to their relative positions. Twice I became lost in the wild mountains of Honduras on account of some grave error in the map, having each time a narrow escape from starvation. As we proceed to Curraren we are surrounded by high walls and mountains of white andesite tufa, which are built upon each other in the form of terraces. On the white surface of the mountains numerous veinlets or lodes of mineral deposits, such as copper, silver, and lead, intersect each other, indicating, in the distance, by their greenish or reddish colored outcorps, the probable existence of some valuable mineral deposits. We really encounter the "main body" on our arrival on the top of the mountain, and find a large vein of argentiferous gold quartz, which is worked at present by some enterprising native.

It is impossible to speak of series or ranges of mountains in this district; the whole neighborhood is but a chaos of mountains, some half-destroyed or gone, others only deprived of their original "caps" of porphyry, which at one time crowned their gigantic forms.

The terraced fronts of the mountains before us are of a decidedly columnar sub-arrangement, and principally so when most exposed to the action of water and air.

The tendency of basalt, andesite, rhyolite, and a number of other eruptive rocks to assume a columnar structure appears mainly after original coherent and firm material has undergone some alteration and decomposition by aid of atmospheric influences.

There is no stability in those columnar walls, traversed with horizontal bands or layers of clay. As soon as the latter are taken away

by the action of water, the columns will fall and form a pile of debris at the foot of the mountain, till it is slowly reduced to material light enough for transportation by aid of the rains and rivers.

The duration of the picturesque aspect presented by these mountain façades is limited. With nearly every year new architectural forms of columnar structure appear, until the whole of the mountain has disappeared.

This process of continuous detachment of masses of rock is materially assisted by vegetable growth, which rises in the fissures of the walls. During the dry season the process of vegetation ceases, and dies off. The dry material usually becomes ignited, enveloping the whole district in a slowly-consuming fire. During night time the appearance of those mountain fires is fearfully magnificent. In my memory I see at the present time those burning mountains before me. I remember my hurried ride, on muleback, and I still hear the noise of the bursting and falling rocks.

The occurrence of prairie and mountain fires, principally in the hot and low regions of Honduras, contributes, to a great extent, towards a rapid decay of the present mountain forms.—M. J. R. FRITZ-GAERTNER, PH.D.

(*To be continued.*)

GEOLOGY AND PALEONTOLOGY.

The Barking Sands of the Hawaiian Islands. — The following is an abstract of a paper read on this subject read before the American Association for the Advancement of Science, at Indianapolis, August, 1890:

About a year ago I read to this association a condensed account of an examination of the Mountains of the Bell (Jebel Nagous) on the Gulf of Suez, and of the acoustic phenomenon from which it is named. In continuation of my researches on sonorous sand, which are conducted jointly with Dr. Alexis A. Julien, of New York, I have now visited the so-called "Barking Sands" on the island of Kauai. These are mentioned in the works of several travelers (Bates, Frink, Bird, Nordhoff, and others), and have a world-wide fame as a natural curiosity; but the printed accounts are rather meagre in detail, and show their authors to have been unacquainted with similar phenomena elsewhere.

On the south coast of Kauai, in the district of Mana, sand-dunes attaining a height of over one hundred feet extend a mile or more nearly parallel to the sea, and covering hundreds of acres with the water-worn and wind-blown fragments of shells and coral. The dunes are terminated on the west by bold cliffs (Pali), whose base is washed by the sea; at the east end the range terminates in a dune more symmetrical in shape than the majority, having on the land side the appearance of a broadened, truncated cone. The sands on the top and on the landward slope of this dune (being about 100 yards from the sea) possess remarkable acoustic properties, likened to the bark of a dog. The dune has a maximum height of 108 feet, but the slope of sonorous sand is only sixty feet above the level field on which it is encroaching. At its steepest part, the angle being quite uniformly 31°, the sand has a notable mobility when perfectly dry, and on disturbing its equilibrium it rolls in wavelets down the incline, emitting at the same time a deep base note of a tremulous character. My companion thought the sound resembled the hum of a buzz-saw in a planing-mill. A vibration is sometimes perceived in the hands or feet of the person moving the sand. The magnitude of the sound is dependent on the quantity of sand moved, and probably to a certain extent upon the temperature. The drier the sand, the greater the amount possessing mobility, and the louder the sound. At the time of my visit the sand was dry to the depth of four or five inches; its temperature three inches beneath the surface was 87° Fahrenheit, that of the air being 83° in the shade (4.30 P.M.).

When a large mass of sand was moved downward I heard the sound at a distance of 105 feet from the base, a light wind blowing at right angles to the direction. On one occasion horses standing close to the base were disturbed by the rumbling sound. When the sand is clapped between the hands a slight, hoot-like sound is heard; but a louder sound is produced by confining it in a bag, dividing the contents into two parts, and bringing them together violently. This I had found to be the best way of testing seashore sand as to its sonorousness. The sand on the top of the dune is wind-furrowed, and generally coarser than that of the slope of 31°, but this also yielded a sound of unmistakable character when so tested. A bag full of sand will preserve its power for some time, especially if not too frequently manipulated. A creeping vine with a blue or purple blossom (kolo-kolo) thrives on these dunes, and interrupts the sounding slope. I found the main slope 120 feet long at its base, but the places not covered by this vine gave

sounds at intervals 160 paces westward. At 94 paces further the sand was non-sonorous.

The native Hawaiians call this place Nohili, a word of no specific meaning, and attribute the sound caused by the sand to the spirits of the dead (uhane), who grumble at being disturbed; sand-dunes being commonly used for burial-places, especially in early times, as bleached skeletons and well-preserved skulls at several places abundantly show.

Sand of similar properties is reported to occur at Haula, about three miles east of Koloa, Kauai; this I did not visit, but, prompted by information communicated by Hon. Vladimar Knudsen, of Waiawa, I crossed the channel to the little-visited island of Niihau. On the western coast of this inlet, at a place called Kaluakahua, sonorous sand occurs on the land side of a dune about 100 feet high, and at several points from 600 to 800 feet along the coast. On the chief slope, thirty-six feet high, the sand has the same mobility, lies at the same angle, and gives when disturbed the same note as the sand of Kauai, but less strong, the slope being so much lower. This locality has been known to the residents of the island for many years, but has never been before announced in print. This range of dunes, driven before the high winds, is advancing southward, and has already covered the road formerly skirting the coast.

The observations made at these places are of especial interest because they confirm views already advanced by Dr. Julien and myself with regard to the identity of the phenomena on sea-beaches and on hill-sides in arid regions (Jebel Nagous, Rigii-Rawan, etc.). The sand of the Hawaiian Islands possesses the acoustic properties of both classes of places; it gives out the same note as that of Jebel Nagous when rolling down the slope, and it yields a peculiar, hoot-like sound when struck together in a bag like the sands of Eigg, Manchester, Mass., and other sea-beaches,—a property that the sand of Jebel Nagous fails to possess. These Hawaiian sands also show how completely independent of material is the acoustic quality, for they are wholly carbonate of lime, whereas sonorous sands of all other localities known to us (now over one hundred in number) are silicious, being either pure selex or a mixture of the same with silicates, as feldspar.

The theory proposed by Dr. Julien and myself to explain the sonorousness has been published elsewhere, but may properly be briefly stated in this connection. We believe the sonorousness in sands of sea-beaches and of deserts to be connected with thin pellicles or films of air, or of gases thence derived, deposited and condensed upon the surface of the sand-grains during gradual evaporation after wetting by

the seas, lakes, or rains. By virtue of these films the sand-grains become separated by elastic cushions of condensed gases, capable of considerable vibration, and whose thickness we have approximately determined. The extent of the vibrations, and the volume and pitch of the sounds thereby produced after any quick disturbance of the sand, we also find to be largely dependent upon the forms, structures, and surfaces of the sand-grains, and especially upon their purity or freedom from fine silt or dust. (Proceedings American Association Advancement Science, 38, 1889.)

"I should be lacking in courtesy to close this without expressing my great obligations to Mr. H. P. Faye, of Mara, and to Mr. George S. Gay, of Niihau, for both a generous hospitality and a sympathetic assistance in carrying out my investigations."

The speaker exhibited photographs of the locality and a specimen of the sand.

In his search after this remarkable sand, Dr. Bolton has had many interesting adventures. He thus describes his first discovery that such a thing as musical sand existed:

"I was walking along the ocean beach at a small place on the northeastern coast of Massachusetts. Suddenly it seemed a dog was barking at me with a peculiar hoarse bark. I stopped and looked around, but the barking had ceased, and there was not a dog nor a living being near. I walked on, and the sound immediately began again. I was puzzled until I looked down and found that my steps in the sand caused the noises. I then gave a vigorous kick into the dry sand, and a prolonged, dismal howl answered me, as though I had kicked a dog. I was astounded. I called some boys to me, and asked them if they had ever noticed that the sand made a noise when people walked on it.

"'Oh, yes!' they said, 'this is the famous musical beach.'

"I felt pretty cheap, for I had never heard of the famous musical beach. I asked them if there was any other place where such sand was found.

"'Not in the United States,' answered the oldest boy, 'but my papa says there is some of it in the Sandwich Islands, where he went one time.'

"When anybody tells me a thing is the only one of its kind I immediately begin to doubt it. I determined then and there to investigate the subject of 'barking' sand. That was in 1883, and much of my time since then has been occupied in my investigations. I have found the sand in small quantities in some seventy places in the

United States, one place in Mexico, one in South America, one in the Sandwich Islands, and one in Arabia."

In 1888, Dr. Bolton went to Arabia, where he had heard there was a beach of the remarkable sand. When he reached that country he found a journey of two weeks across a terrible desert would be necessary to reach the beach, which was on the Gulf of Suez. The Arabs had heard of the "singing" sand, and had a superstitious fear of it. The sheik of the tribe where he was refused to send any of his men with the explorer. Finally, persuasion and gold won him, and a caravan of fourteen camels and as many men set out. There was not a drop of water, no vegetation, no food,—only glaring, drifting sand. All the water and all the food had to be carried with them. It was four weeks before the caravan returned from the desert. It came back worn, weary, and nearly famished, but triumphant, for Dr. Bolton had found the finest beach of musical sand he had ever seen.

Last year he went to the Sandwich Islands, and found more of the sand, just as the little boy had said when he gave the doctor his first information about this curious natural formation. In Southern California is a huge sand-dune, on which are patches of the musical sand. This dune is about seventy feet high; shaped like the half of a lens. The following legend is connected with the spot:

Many years ago there was a flourishing monastery at this place, but, owing to the wickedness of the monks, it was overwhelmed by drifting sand. The monastery bells, however, were not involved in the fall of the monks, having been blessed with due ceremony by high ecclesiastics, hence the sound of these holy bells are still heard at matins and vespers. The only similar sonorous dunes known are Jebel Nagous, in Arabia, Rig-i-Rawan, in Afghanistan, and one of a similar name in Persia, Nohili, in Kauai, and possibly one in Churchill county, Nevada.

On Two New Species of Mustelidæ from the Loup Fork Miocene of Nebraska.—Stenogale robusta sp. nov.—Established on a left mandibular ramus which lacks only the posterior border, and which contains in place the molars two to five inclusive, and the root of the canine. The technical characters are those of Stenogale Schlosser, differing only from Mustela in the cutting-blade of the heel of the inferior sectorial. The species is much more robust than those referred to the genus by Dr. Schlosser. The inferior border of the ramus below the coronoid process, is obliquely flattened, and inflected in a way not seen in the *Mustela pennantii*, forming a strong inferior border to the masseteric fossa. The dental foramen is a little

above the angle of this inflection, and is below the middle of the coronoid process. There are several small mental foramina. The canine tooth is of large size. The fourth premolar is close to it, and is one-rooted. Other premolars with compressed crowns, the first with a weak posterior cutting lobe. The sectorial has the proportions seen in Mustela, and possesses a well-marked metaconid. The blade of the heel is external, and there is a low internal basal cingulum of the heel only. Tubercular molar small, one-rooted.

Measurements.—Length of dental series, 47 mm.; diameter of base of canine, 7 mm.; length of premolar series, 22 mm.; length of sectorial, 12 mm.; length of heel of, do, 5 mm.; depth of ramus at P. M. $_{4}$, 13 mm.; do, at sectorial, 14 mm.

The depth and thickness of this ramus are identical with those of the jaw of the *Mustela pennantii*, but the length is considerably less.

Brachypsalis pachycephalus gen. et. sp. nov. *Char. gen.* Dental formula: I.?; C. $_{1}$; P. M. $_{4}$; M. $_{2}$. Inferior sectorial with a wide basin-shaped heel, which is as long as the contracted blade; a metaconid.—This genus has the dental formula of the typical Mustelæ, but it is extremely microdont, having a small sectorial blade and wide basin-shaped heel as in the genus Lutra, to which it is evidently allied.

Char. specif.—Founded on a left mandibular ramus which lacks the portions anterior to the canine, and posterior to the coronoid. The sectorial is the only tooth preserved. Posterior border of the heel lobulate. P. M. $_{4}$ well developed, one-rooted. P. M. $_{3}$ with the anterior root reduced. P. M. $_{2}$ and $_{1}$ very robust, no. $_{1}$ shorter than the sectorial. M. $_{2}$ robust, the root grooved on each side. At the P. M. $_{1}$ the ramus is twisted externally. The anterior face of the coronoid is as wide as the ramus at the sectorial, and the M. $_{1}$ is in front of its internal border. The dental foramen is behind the base of the coronoid, a little nearer the alveolar level than the inferior border of the ramus. Masseteric fossa strongly defined in front and below, and with a distinct median fundus.

Measurements.—Length of dental series from and exclusive of canine, 55 mm.; length of premolar series, 31 mm.; length of sectorial, 14.5 mm.; length of heel, 7 mm.; width of, do, 8 mm.; depth of ramus at sectorial, 25 mm.; width of base of coronoid just behind M. $_{2}$, 14 mm.

This very robust species represented the otters in the central part of North America, during the Loup Fork epoch. Its dimensions were

probably about those of the sea-otter (*Enhydris marina*). No form representing the otters has been known hitherto from this region; but a much smaller species, *Lutrictis lycoptamicus* Cope, has been described from probable Loup Fork beds of Oregon.—E. D. COPE.

Macfarlane's American Geological Railway Guide.[1]—This book is one of especial utility to the geologist, since it is an index to the book of nature, whose pages are disclosed to us in the railway cuttings of the country. Such exposures are the principal source of geological knowledge in the eastern region of our continent, where the generous rain-fall covers the natural scars and abrasions of the earth's surface with ample vegetation. The preparation of such a work was a happy inspiration of the late James Macfarlane, and that a second edition is called for shows that it has met with deserved appreciation. The authorities of the country are generally cited, and information is compiled from all available sources. We think a few more maps would be of much utility. We also find the treatment of the Cenozoic formations to be less thorough than that accorded those of the ages which preceded them. The nomenclature adopted is generally that required by priority, the only exception being found in the reports of Messrs. S. F. Emmons and G. K. Gilbert, of the U. S. Geological Survey, where some names are used which are not warranted by the law of priority or by general custom. Such is the use of Niobrara instead of Loup Fork. Niobrara is the name of a Cretaceous horizon, and has nothing to do with the Loup Fork Miocene.

A Catalogue of British Fossil Vertebrata.[2]—This work supplies a want that paleontologists have felt who are desirous of learning the extended literature of vertebrate paleontology as developed by Englishmen or on English material. This literature is largely prior, of course, to that of America, and it is especially important for Americans to become acquainted with the sources of information and of nomenclature so far as they apply to the paleontology of their country. In this work they will find it fully indexed, and full references given. A nomenclature has been adopted by the authors, so far as it has been personally investigated by them, based on the rules promulgated by all scientific bodies; but in cases where they have followed others they have not adhered to them in that one

[1] An American Geological Railway Guide. By James Macfarlane, Ph.D. Second edition edited by James R. Macfarlane. New York: D. Appleton & Co. 1890. 8vo. pp. 426.

[2] A Catalogue of British Fossil Vertebrata, by Arthur Smith Woodward and Charles Davies Sherborn. London: Dunlan & Co., 37 Soho Square. Jan., 1890. 8vo. pp. 398.

which requires a diagnosis or description for every name as a necessary condition of priority. Thus we find Platychœrops, Protosphyræna, and Hipparion, for which their authors published no separate diagnosis, adopted instead of Miolophus, Erisichthe, and Hippotherium, which were accompanied by diagnoses when first proposed. We hope that in a second edition the work may be made uniform in this respect.

The Cretaceous Saurians of New Zealand.—Prof. James Hector's explorations in New Zealand have led to the accumulation of several tons of blocks of cement-stone containing fossil bones, which have been worked out of the hard matrix by Mr. McKay. The general result is that portions of 43 individual reptiles, mostly of gigantic size, and all of aquatic habits, belonging to at least 13 distinct species, have been discovered. These species represent two distinct groups, the first being true Plesiosaurians belonging to the genera Plesiosaurus, Maurisaurus Hector (gen. nov. allied to Elasmosaurus Cope), and Polycotylus Cope; the other representing probably the order Pythonomorpha. This order is represented by two distinct genera, Liodon Owen and Taniwhasaursus Hector (gen. nov. allied to Clidastes of Cope). In addition, there are several fragmentary remains, placed provisionally under one or the other of these groups, and two vertebræ belonging to an exceptional form of the genus Crocodilus. Lastly, there is a single vertebrate from Mt. Potts referred to the genus Ichthyosaurus. Plates with descriptions of these interesting fossils are found in the Transactions New Zealand Institute, Vol. VI. A fine series of these saurians has been recently received in Philadelphia by Prof. Cope, who will add them to his private collection.

A Bison at Syracuse, New York.—A bovine skull was exhumed (in laying a sewer) from about ten feet below the surface of the ground, at Syracuse, N. Y. The formation was of black swamp muck underlaid by clay; the skull being found at the junction of the two deposits. No other bones were found. I append a few measurements: Foramen magnum (superior border) to occipital crest, 4½ in.; width of condyles, 5¼ in.; width of skull between horns and eyes, 10¼ in.; width of skull between meati audit. ext., 9⅝ in.; from foramen magnum to end of premaxillæ, 20 in.; width from zyg. arch to its fellow, 9⅝ in.; width of palatines opposite last molar, 3¾ in.; width across premaxillary bones, 4 in.; length of alveoli, 6⅝ in.; nearest approach of orbits to each other, 10½ in.; length of nasals, 8½ in.; width of nasals, 2½ in.; occipital crest to nasal, 10¼ in.; frontal suture closed except 2½ in.; circumference of horns at base, 14 in.; length of horn,

greater curvature, 15½ in.; length of horn, lesser curvature, 10 in.; distance from tip to tip of horns, 17¾ in.; distance from base to base of horns, 10¼ in.—LUCIEN M. UNDERWOOD, *Syracuse University, Syracuse, N. Y.*

NOTE BY EDITOR.—Photographs of this skull sent by Mr. Underwood show that it belongs to the bison, *Bos americanus*. This is, I believe, the most northern locality at which it has been found east of the Mississippi valley.—E. D. COPE.

Geological News.—Palæozoic.—In a review of Dr. Ells's Report on the Geology of a Portion of the Province of Quebec, C. D. Walcott agrees with the author in condemning the name Quebec group. In view of many new facts brought to light by the study of the past fifteen years it has become misleading and unintelligible. In its stead Dr. Ells's proposes to use the name Levis for the local development of the Calciferous terrane about Quebec, and the name Sillery for the passage beds and Cambrian strata of the St. Lawrence valley in the vicinity of Quebec. This suggestion has the hearty endorsement of Mr. Walcott.

C. R. Van Hise (Bull. Geol. Soc. Am., Vol. I., pp. 203–244) confirms Newton's views as to the eruptive origin of the granite core of the Blacks Hills, and its pre-Cambrian age. He further states that the zone of schists about it was developed and deeply eroded before the beginning of Palæozoic time.

Sir Wm. Dawson and Dr. G. J. Hinde have recently described some new species of fossil sponges from the Siluro-Cambrian at Little Metis, on the lower St. Lawrence. These specimens are especially interesting since they throw fresh light on the character of the earliest-known forms of these organisms, and their discovery is the more opportune from the fact that our knowledge of the existing hexactinellid sponges —the group to which nearly all these fossils belong—has been vastly increased by the work of Prof. F. E. Schulze, of Berlin, on the hexactinellid sponges dredged up by the Challenger Expedition, and thus we are now better enabled than hitherto to compare the fossil and recent forms. Twelve species, representing six genera, are described and figured.

The second part of the Contributions to the Micro-Paleontology of the Cambro-Silurian Rocks of Canada has been prepared by E. O. Ulrich. It consists of a descriptive report on some fossil Polyzoa and Ostracoda from Manitoba, and is illustrated by two full-page litho-

graphic plates. Of the twenty-five species of Polyzoa eleven are new. The Ostracoda are few, and not in good condition. There are but nine species in all, five of which are new.

The study of the Calciferous formation in the Champlain valley by Profs. Brainard and Seeley has brought a series of surprises: 1. The thickness of the rocks,—little less 2000 feet. 2. The amount of magnesian limestone. 3. The amount of pure limestone. 4. The abundance of fossil forms. 5. The almost entire exclusion of the bird's-eye formation from the Vermont rocks. (Bull. Geol. Soc. Am., pp. 501–516.)

In the Proc. U. S. Nat. Mus., Vol. XII., are found descriptions by C. D. Walcott of fossils from the Lower Cambrian. Of seven corals, two, *Archæocyathus dwightii* and *Ethmophyllum meekii*, are new species. Of worms and molluscs there are three new genera and thirteen new species.

In a report on the Natural Gas in Minnesota Prof. N. H. Winchell makes the following statement: "So far as science affords any evidence in favor of gas below the Trenton limestone in Minnesota, there is perhaps one chance in ten that the formation which is known in the northern part of the State as *Animike slates* and *quartzites*, underlies the county of Freeborn at a depth of 3000 feet. In case it were found at that depth there might be one chance in one hundred that it would contain some gas, and one in a thousand that it would afford enough for economic purposes." (Bull. No. 5, Geol. and Nat. Hist. Survey, Minn.)

Prof. Edw. Orton states as a law that "The pressure of Trenton limestone gas is due to a salt-water column, measured from about six hundred feet above tide to the level of the stratum which yields the gas." (Bull. Geol. Soc. Am., Vol. I.).

In view of the fact that the use of the name Hudson River group has been attended with more or less uncertainty ever since it was promulgated by the geologists of the New York Survey, Mr. C. D. Walcott proposes to use the term Hudson in a generic sense to include a group of formations that occur between the Trenton limestone horizon and the Upper Silurian or Niagara horizon. (Bull. Geol. Soc. Am., Vol. I., pp. 335–356.)

Carbonic.—C. R. Keyes, in discussing variation of a carbonic gastropod, *Platycerus equilaterum* (*Am. Geol.*, June, 1889), emphasizes the fact that accidental station is not the only factor in modifying the form of the shell, but that gravitation also exerts a potent influence.

In America there are probably about a dozen valid species of Naticopsis, the others described as such being identical with forms previously known. *Patica littonana* Hall, from the Warsaw limestone, apparently belongs to the globose group of *Soleniscus*, and will therefore stand as *S. littonanus*. For *Isonema depressa* M. and W. it is proposed to substitute the name *Naticopsis linearis*. (C. R. Keyes, *Am. Geol.*, October, 1889.)

H. A. Wasmuth, in the *Am. Geol.*, May, 1888, closes a description of the Pittsburgh Coal Bed with a reference to the Devonian formations, reservoirs of gas and oil, that underlie it. Naturally, the greatest amount of gas should be found on the higher elevations (anticlinals), and of oil in the deeper portions of synclinals of the Devonian formations; but as this theory is refuted by geologists of reputation, there remains the influence of disconnections and dislocations of the oil- and gas-bearing strata by clay veins, etc., to explain the productivity of the oil- and gas-wells of Pennsylvania.

Jurassic.—R. Lydekker announces the discovery of a new crocodile, *Suchodus durobrivensis*, from the Oxford clay of Peterborough. (*Quar. Jour. Geol. Soc.*, May, 1890.)

A. Smith Woodward notes three small Ichthyolites from the Paper Shales of Wigston, referable to a small species of Pholidophorus, *P. nitidus* Egerton. (Trans. Leicester Lit. and Philosoph. Soc., April, 1889.)

R. Lydekker has referred two vertebræ, one from the Wealden of Cuckfield, the other from the Wealden of Brook, to *Pleurocœlus valdensis*. Their especial interest lies in the circumstance that, in connection with some opisthocœlous teeth, they afford absolutely conclusive evidence of the occurrence in the English Wealden of a diminutive opisthocœlous Dinosaur, which was the contemporary of the huge Ornithopsis, and the still more gigantic Pelorosaurus. (*Quar. Journ. Geol. Soc.*, May, 1890.)

Cretaceous.—According to Robert T. Hill (*Am. Geol.*, 1889) the Cretaceous exposures of the Texas-Arkansas region record two subsidences. Of the total sediments of the Lower, aggregating over 2,000 feet, 1,500 are limestone, all but 100 feet of which are of foraminiferal origin. Of the 700 feet of limestone of the Upper Cretaceous formation of Texas 600 feet are of foraminiferal origin.

J. S. Newberry (Trans. N. Y. Acad. Sci., Vol. IX.) gives the following reasons for considering the Laramie the upper member of the

Cretaceous, as first determined by Cope: 1st. It contains an invertebrate fauna that has in it many Cretaceous elements; *Mactra alta*, *Cardium speciosum*, and several species of Inoceramus being also found in the Fox Hill group. 2d. It contains, according to Cope and Marsh, a vertebrate fauna which is decidedly Cretaceous in character. 3d. The somewhat numerous mammals obtained from the Laramie by Cope and Marsh are reported by them to have decided Mesozoic characters.

Cenozoic.—Some fossil fish remains found in the Oligocene strata in the Isle of Wight have been referred by Mr. E. T. Newton to the genus Clupea and named *C. vectensis*. (*Quart. Journ. Geol. Soc.*, Feb. 1889).

Of seven species of fossil butterflies from Florissant, Cal., described by S. H. Scudder, six are new, and are referred by him to five new genera. Five of the seven belong to the sub-family Nymphalinæ, one to Pierinæ. The last represents a nearly extinct type, the sub-family Libytheinæ, and is of especial interest.

M. Deydier has found in the fresh-water limestone deposits of Ratavoux, near Cucuron, a mandible of *Castor jægeri* Kaup, a true Miocene species, which has not heretofore been recorded in the Leberon fauna. (Bull. Soc. Geol. de France, Tome dix-huitiéme.)

A fossil fish found in the Pliocene deposits near Antwerp has been referred by Raymond Stomes to the genus Thynnus, under the name *T. caldisii*. (Bull. Soc. Belge de Geol. de Paleon. et d'Hydrol., 1889.)

Plistocene.—In the Trans. Roy. Soc., 1889, Dr. J. W. Spencer discusses in detail the best developed beach of the Ontario basin, to which he gives the name Iroquois Beach. He does not agree with Mr. Gilbert as to the existence of glacial barriers closing the St. Lawrence valley. Not only is it unnecessary to believe in the existence of such a barrier to keep out the sea-water, as witness the present Gulf of Obi, but it seems impossible to believe in the existence of great glacial dams above sea-level sufficiently permanent to develop such regular beaches and terraces as the Iroquois, which indicate a wave-action of as long duration as that upon the modern beaches of Lake Ontario.

According to Dr. Spencer, in a paper read before the Geological Society of America, soundings demonstrate the presence of submarine valleys reaching upon all our coasts to depths of 3,000 feet or more; that these soundings show that within comparatively short distances

from their mouths the depth of the valleys, below the surface of the sea, sometimes did not exceed from 1,200 to 1,800 feet, but that beyond there was a greater increase of depth, within the last few leagues. In the fiords of Norway, merging into rapidly-contracting valleys, or headed by great vertical walls, hundreds of feet in height, may be seen the counterpart of the coast of the American continent just preceding the Plistocene period.

BOTANY.

Botany at the Indianapolis Meetings.—In the several meetings held in Indianapolis in August, including the American Association for the Advancement of Science, the Botanical Club, and the Society for the Promotion of Agricultural Science, there were many good papers on botanical subjects; in fact, it may be said that the average rank of the papers was considerably higher than in previous years. In the sessions of the Society for the Promotion of Agricultural Science the following botanical papers were read:

1. Preliminary Note on the Rotting of the Potato, by T. J. BURRILL; detailing experiments which show that in many cases, at least, the actual cause of the rotting is a Bacterium morphologically similar to *B. termo*, but differing from that species in its deportment towards nutrient media.

2. The Rots of the Sweet Potato, by B. D. HALSTED; indicating that there are four or five apparently distinct kinds of rots, due to the attacks of as many species of fungi.

3. Some Fungous Root Diseases, by L. H. PAMMEL; referring mainly to the cotton and sunflower plants.

4. The "Scab" of Wheat-Heads, by C. M. WEED; describing a disease of wheat which appears to be due to *Fusisporium culmorum*.

5. Some Recent Observations on the Black-Rot of the Grape, by B. T. GALLOWAY; detailing the results of experiments in inoculating the grape and Virginia creeper with ascospores, pycnidiospores, etc., of Phyllosticta.

6. A Comparative Test of Some of the Copper Preparations in the Treatment of Black-Rot of Grapes, by B. T. GALLOWAY; showing that by the use of such solutions the disease may be greatly reduced.

7. Biological Factors in the Nutrition of Plants, by M. MILES; referring to the rôle of micro-organisms in plant nutrition, and giving the results of experiments upon "clover tubercles."

8. The Forage Problem on the Plains, by C. E. BESSEY; discussing the native grasses and the factors which control their distribution, and suggesting those worthy of cultivation.

9. Cucurbita an American Genus, by E. L. STURTEVANT. In this paper, after referring to the fact that Cogniaux, in his Monograph of the Cucurbitaceæ (1881), recognizes ten species, of which six are acknowledged to be strictly American, the author proceeds to show that the remaining species, viz.: *C. maxima*, *C. pepo*, *C. moschata*, and *C. ficifolia*, are also presumably of American origin. Six lines of argument seem to show that the position is well taken, viz.: (1) the absence of authentic instances of the recognition of pumpkins, squashes, etc., by the ancients of prehistoric times; (2) the sequence of the European recognition which appears in the nomenclature seems to imply an introduction after the discovery of America; (3) the vernacular names of the four species appear from historical evidence to have originated after the discovery of America; (4) the vernacular names on structural grounds appear to be of American origin; (5) herbarium specimens (very scanty in fact) indicate American as much as Old World origin; (6) in the scanty notices by older writers on Asiatic plants these species appear, either by statement or implication, to be introduced.

The botanical papers read before Section F numbered twenty-seven in all, as follows:

1. The Forest Trees of Indiana, by STANLEY COULTER; being a commentary upon the list of forest trees (106 species) of the State. The distribution appears to be dependent mainly upon the water supply, and not upon the richness of the soil, geological formation, or altitude above the sea.

2. Preliminary Notes Upon a New and Destructive Oat Disease, by B. T. GALLOWAY; calling attention to a disease which attacks the leaves and stems of the oat, causing a discoloration of the tissues. A *Bacillus* was found, and this was shown by inoculations to be the cause of the disease, which appears to be widespread, cases having been reported from New England to Illinois and southward.

3. Observations on the Variability of Disease Germs, by THEOBALD SMITH; citing certain variations by him in the bacilli of "hog cholera."

4. The Trimorphism of *Uromyces trifolii* (Alb. and Schw.) Wint., by J. K. HOWELL; detailing investigations made to show that the Æcidium of clover (*Æ. trifolii-repentis*) is genetically connected with the teleutospore stage known as *Uromyces trifolii*. By means of care-

ful infections conclusive proof of the identity of the species was obtained.

5. Observations on the Life-History of *Uncinula spiralis* B. & C., by B. T. GALLOWAY; giving the results of a study of the germination of the ascospores.

6. On the Seed-Coats of the Genus Euphorbia, by L. H. PAMMEL. From a study of the structure of the seed-coats it is evident that distinguishing marks may be obtained from them.

7. Observations on the Method of Growth of the Prothallia of the Filicineæ, with Reference to their Relationships, by D. H. CAMPBELL. The author called attention to the similarity between the development of the prothallia of Filicineæ and the thalli of the Hepaticæ, and suggested that the two groups are genetically related.

8. Development of the Sporocarp of *Griffithsia bornetiana*, by V. M. SPALDING. A careful study of alcoholic material enabled the author to follow the development of the sporocarp step by step.

9. Contributions to the Life-History of Isoëtes, by D. H. CAMPBELL; giving many points in the development of the macrospore and the female prothallium. There are indications that Isoëteæ are related to the Marattiaceæ.

10. The Relation of the Mexican Flora to that of the United States, by SERENO WATSON; giving first a sketch of the physical features of the continent as they affect plant distribution, then recognizing and defining three botanical regions, viz.: the Atlantic, the Interior (Plains and Rocky Mountains), and the Pacific. After citing examples of families and genera the conclusion was reached that there is a closer connection between the Mexican flora and that of the Atlantic region than with that of either the Interior or Pacific.

11. Distribution of the North American Umbelliferæ, by J. M. COULTER. The Umbelliferæ of North America appear to be massed within the United States (especially northwestward), having spread southward from an Arctic and possibly from an Asiatic origin. The genus Peucedanum is the great North American umbelliferous group, and all its species are west of the Mississippi River, forty being peculiar to the Pacific States. Cymopterus is a Great Basin genus. The Great Plains contain but few species.

12. Distribution of the Hepaticæ of North America, by L. M. UNDERWOOD; referring to our meagre knowledge of our species (but 265 being known), and discussing as far as possible their general range. Four botanical provinces appear to be indicated for North America, viz.: Boreal, Medial, Austral, and Occidental, to which may also be

added the Mexican. The richest region in species is probably that extending from Washington southward along the coast, thence westward to Southern California.

13. The Migration of Weeds, by B. D. HALSTED; giving examples of the travels of some of the more common weeds of the country.

14. The Geographical Distribution of North American Grasses, by W. J. BEAL. Of the 298 genera of grasses we have 115, with 25 more introduced. Of the 3200 species in the world we have 850 natives, and 125 more introduced, making 975 in all, or considerably more than one-fourth of the whole. Bouteloua is represented by all its species (27), as is the case also with a number of smaller genera, many of which are peculiar to North America.

15. The Geographical Distribution of North American Cornaceæ, by J. M. COULTER. Of the three genera Garrya is peculiarly an American genus; its species are mainly Mexican, extending into the Pacific region. Nyssa is eastern. Cornus is doubtless of northern origin, which has, while moving southward, been separated by the Great Plains into a western and an eastern group.

16. The General Distribution of North American Plants, by N. L. BRITTON. The author divided the North American flora into a northern (British America, the Sierras, the Rocky Mountains, and the Alleghanies) and a southern region (Atlantic Coast, Mississippi Valley, and a part of California). Referring to the influence of the glacial climate, he pointed out many difficulties in the usual method of accounting for the present northern flora.

17. The Work of the Botanical Division of the Department of Agriculture, by F. V. COVILLE. Two main lines of work have been undertaken, viz.: (1) the study of economic problems, especially those relating to grasses and forage plants; and (2) systematic work upon the flora of the country. Publications in two series (economic and scientific) are made from time to time.

18. The Development and Function of the So-called Cypress "Knees," with a Consideration of the Natural Habitat of the Tree, by W. P. WILSON; showing by means of lantern slides the peculiarities of structure of the root-system of the cypress (*Taxodium distichum*) of the Southern States. Several methods of the formation of knees were fully illustrated and discussed. The conclusion was that the cause of their formation is physiological and not mechanical.

19. The Potato Scab, a Bacterial Disease, by L. H. BOLLEY. For want of time this paper was read before the Botanical Club.

20. The Continuity of Protoplasm Through the Cell-Walls of Plants, by W. J. BEAL and T. W. Tuomey; giving the results of a long series of observations.

21. Preliminary Note on the Genus Rhynchospora in North America, by N. L. BRITTON; being an enumeration of the species now known to inhabit North America.

22. On Rusbya, a New Genus of Vacciniaceæ from Bolivia, by N L. BRITTON. An interesting new genus of parasitic plants.

23. Notes on a Monograph of the Genus Lechea, by N. L. BRITTON.

24. The Specific Germs of the Carnation Disease, by J. C. ARTHUR and H. L. BOLLEY; giving the results of a very complete study of the bacterium, which is shown to be the cause of the disease.

25. Notes Upon Plants Collected by Dr. Edward Palmer at La Paz, Lower California, by J. N. ROSE. Read by title only.

26. Notes Upon Crystals in Certain Species of the Arum Family, by W. R. LAZENBY; giving microscopical details of a study of thecrystals.

27. Notes on *Isopyrum biternatum*, by C. W. HARGITT; giving the results of the anatomical study of the root-tubers.

The attendance upon the Botanical Club was very good, and the notes and papers were unusually numerous.

1. Dr. Britton, chairman of the club, in a short address upon the Present State of Systematic Botany in North America, noticed the activity in various centres by different investigators. A marked feature of the present is that there has lately been a great increase in the number of specialists.

2. Notes on Nomenclature, by B. E. FERNOW; referring to the need of a revision in both scientific and common names, and noting a considerable number of cases of recent changes in the scientific names of forest trees.

3. An Eastern Station for *Actinella acaulis* Nutt., by C. M. WEED; noting the occurrence of this western plant in Northern Ohio.

4. Notes on the Milky Juice of Plants as a Protection Against Stem-Borers, by C. M. WEED; concluding that the milky juice is a protection against stem-boring insects.

5. Notes on the Root-Tubercles of *Ceanothus americanus*, by W. J. BEAL; noting the occurrence of root-tubercles similar in appearance to those on clover.

6. The Genus Bacterium, by T. J. BURRILL; protesting against the loose practice in the application of names which prevails in bacteriology, and insisting that the genus Bacterium, which has latterly been ignored, has a right to existence.

7. A New Hollyhock Disease (*Colletotrichum althææ*), by E. A. SOUTHWORTH; giving the results of studies of this destructive disease, with an account of germinations and inoculations.

8. The Nature of Paleæ and Lodicules in Grasses, by F. L. SCRIBNER; discussing the homologies of the grass-flower and spikelet, and concluding (1) that paleæ are simply prophylla beginning the floral branch, and (2) that the lodicules are true scales belonging to the epidermal system, whose function is to expand the glumes in anthesis.

9. Two forms of *Ampelopsis quinquefolia*, by W. R. LAZENBY; differing in the structure of their tendrils, developing discs in one (native form), and not in the other (cultivated form).

10. On Pollination in the genus Æsculus, by L. H. PAMMEL; detailing the results of studies of several species.

11. Notes on the Adventive Buds of Lycopodium.

12. Notes on the Archegonia of Ferns.

13. Germination of the Spores and the Prothallia of Osmunda. Three papers by D. H. CAMPBELL, giving the results of careful structural studies.

14. Notice of a Descriptive List of the Junci of Texas, by F. V. COVILLE; referring to the work done on Junci for the forthcoming Manual of the Texan Flora.

15. Apparatus for Vegetable Physiology, by J. C. ARTHUR; showing drawing of some new apparatus made in the physiological laboratory of Purdue University.

16. Report on the Botanical Exchange Club, by F. V. COVILLE; reporting that the club is now ready to make exchanges, having on hand about 5000 specimens.

17. Plant Colonists at Akron, Ohio, by E. W. CLAYPOLE; giving a few notes upon certain common introduced plants in Northern Ohio.

18. A Serviceable Collecting Knife, by F. V. COVILLE; being, in short, the "cotton knife" of the Southern States.

19. Double Flowers in Wild Morning Glory (*Convolvulus sepium*).

20. Peculiarites of the Pollen of *Epilobium palustre* var. *oliganthum*.

21. A Supposed Hybrid between *Tragopogon porrifolius* and *T. pratensis*. Three short papers by B. D. HALSTED.

22. A Mode of Spore Discharge in a Species of Pleospora, by MISS E. PORTER.

23. Potato Scab, by H. L. BOLLEY; concluding that the disease is due to bacteria.

On Monday the club made an excursion to Garland Dell, locally known as "The Shades of Death," and had a most enjoyable time

throughout, collecting by the way many plants of interest to those less familiar with the central Indiana flora.

The officers of the club for the next year are: President, Wm. M. Canby; Vice-President, L. M. Underwood; Secretary, B. T. Galloway.

Taken all in all, the botanists of the country have no need of feeling ashamed of the quality of the work done in the association and the related societies.—CHARLES E. BESSEY.

ZOOLOGY.

Heliotropism in Animals.—Groom and Loob[1] think that the daily migrations of pelagic marine animals are to be regarded as caused by heliotropism. In the day-time this is negative, the strong light driving them from the surface; while at night it exercises a positive action, causing them to seek the surface waters. Their observations show that light, and not heat, is the exciting cause. Driesch finds[2] that heliotropism influences the growth of the hydroid Sertulariella.

Excretory Organs of Protozoa.—A. B. Griffiths states[3] that he has proved the existence of uric acid in the contractile vacuoles of Amœba, Vorticella, and Paramecium. The Amœba was killed under the cover-glass with weak alcohol. This was followed by nitric acid, the slide warmed, and then ammonia was drawn under the cover-glass, the result being the formation of crystals of murexide in the contractile vacuole itself, as well as in its excretion. This clearly shows that these organs are for the excretion of nitrogenous waste.

Note on Some Gigantic Specimens of Actinosphærium eichhornii.—In a small pond near the observatory of the State University of Iowa I collected some material which now stands on a table in the laboratory. Minute whitish discs, plainly visible, however, to the unaided eye, may be seen in considerable numbers clinging to the stems and leaves of Ceratophyllum. An examination of these discs reveals the fact that they are gigantic Rhizopods belonging to the genus Actinosphærium. *Actinosphærium eichhornii* they probably are, but they are vastly larger than any individuals of this species usually

[1] *Biol. Centralblatt.*, X., 160 and 219.

[2] *Zoolog. Jarbuch.*, V., p. 147.

[3] Proc. Roy. Soc. Edinburgh, XVI., p. 131.

seen, and larger than any recorded by Prof. Leidy in his work on the "Fresh-Water Rhizopods of North America." The first specimen I measured, in place of being 0.4 mm., the maximum diameter given by Leidy, was 0.85 mm. in diameter, with rays projecting 0.45 mm. beyond the margin of the body. There are scores of individuals in my jar, and the average diameter is in excess of 0.75 mm. The largest specimen measured had a diameter of 1.36 mm., and there are not a few individuals that seem to be equally as large.

It is worthy of record that a large proportion of the specimens that passed under the microscope had been feeding on small specimens of Cyclops. Rotifers seems to be a favorite article of diet with Actinosphærium, and even the individuals that had succeeded in capturing Cyclops contained often three or four Rotifers. Difflugia was taken by a few, but none, so far as observed, had condescended to feed on diatoms or other forms of algæ. It has been a matter of surprise that a creature so sluggish as Actinosphærium should be able to capture Cyclops. How the capture is made I have thus far not been able to determine.—S. CALVIN, *Biological Laboratory, State University of Iowa, September 20, 1890.*

Portuguese Man-of-War.—Mr. Robert P. Bigelow studied[4] the habits of the Portuguese man-of-war (which has lost its familiar name *Physalia arethusa*, and has been rechristened *Caravella maxima* in Haeckel's recent monograph). This form feeds largely on small fish; these, swimming against the tentacles, are caught and benumbed; but apparently their struggles pull the tentacle, which contracts, bringing the prey up to the numerous feeding-bells. If the fish does not struggle the tentacle fails to contract. The feeding-bells spread themselves over the fish and digest it. During the summer of 1889 these splendid siphonophores were very abundant at Woods Holl, Mass., but during the summer of 1890 not a single individual was seen.

Dimorphism in Antipatharia.—G. Brook describes[5] an interesting type of dimorphism in the Antipathidæ. In Schizopathes, Bathypathes, etc., the zooids have become elongated in the transverse axis, so that the six tentacles appear like three pairs. Corresponding with this there is a depression between the oral and lateral regions, so that from the surface each zooid appears like three lobes, each with a pair of tentacles. Internally the lateral portions are separated from the central by a mesoglœal partition, and since the lateral mesenteries

[4] Johns Hopkins Univ. Circ., IX., p. 61. 1890.

[5] Proc. Roy. Soc. Edinburgh, XVI., p. 78.

alone bear reproductive organs, and only on their distal portion, the result is that the division produces from each primitive zooid a gasterozoid flanked by two gonozoids. It is hardly necessary to say that this dimorphism is different from that in the Hydrozoa.

Acanthocephali.—The systematic position of the Acanthocephali has long been a problem, although from similarity of shape they were usually placed near the Nematodes, or round worms. Recently Dr. Hamann has been studying the subject, and finds[6] additional grounds in support of this view. He thinks that the water vascular system is homologous in each, while he recognizes the problematical acanthocephalan lemnisci in cervical or cephalic glands occurring in many Nematodes.

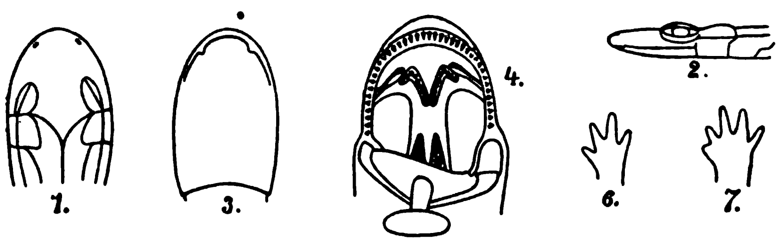
On a New Species of Salamander from Indiana.—At the time of the meeting of the American Association for the Advancement of Science of the present year, at Indianapolis, Mr. A. W. Butler, of Brookville, Indiana, presented me with three specimens of a species of Salamander which were taken in a spring near to Brookville. Two of these were living, while the third is an alcoholic specimen from a collection which embraces a number of other individuals from the same locality, belonging to Mr. Butler.

The three specimens represent young, middle-aged, and mature individuals, which have passed their metamorphosis. They agree nearly in their characters. They belong to a species which resembles the *Spelerpes longicaudus*, but are distinct in form, color, and habits, and belong, moreover, to the genus Gyrinophilus. The premaxillary bones are of feeble structure, and the spines are distinct and widely separated, contrary to the structure in the genus Spelerpes. The mature individuals, of which Mr. Butler possesses several, are much more robust than those of *S. longicaudus*, having a short body and relatively long premaxillary region and head. With this the tail is as long as in the *S. longicaudus*, and is similarly compressed. The entire animal is larger. The color is different from that of the *S. longicaudus*. It is vermilion-red, as in *S. ruber*, and the superior surfaces of the head and body are irregularly spotted with dark brown. The sides of the tail are similarly irregularly brown-spotted, the spots not showing the least tendency to form the vertical bars characteristic of the *S. longicaudus*. The form of the series of vomerine teeth is different. Instead of commencing at the posterior border of the internal nares, they commence opposite to the anterior border of the same, and

[6] *Zoolog. Anzeiger*, XIII., p. 210. 1890.

send posteriorly a short branch along the internal border of the choana, thus giving a hook-shaped outline to each series. The proportions are as follows:

Width of head five times in length of head and body. Length of head to axilla two and a third times into total length of head and body to groin. Tail one and a-half times the length of the head and body. When the limbs are extended, the posterior toes reach the distal extremities of the metacarpals. Thirteen costal folds. The width of the head is half the length to above the middle of the humerus. The canthus rostralis is distinct, though not so strongly marked as in *Gyrinophilus porphyriticus*. Total length, 152 mm.; length to angle of mouth, 8 mm.; to axilla, 23 mm.; to groin, 53 mm.; to extremity of vent, 62 mm.



Gyrinophilus maculicaudus Cope; $\frac{4}{3}$ natural size. Fig. 1, head, from above; Fig. 2, head, from below; Fig. 3, head, profile; Fig. 4, interior of mouth, $\frac{5}{3}$ natural size; Fig. 6, fore foot, from below; Fig. 7, hind foot.

In the adult specimens the subnareal processes are quite prominent. In young specimens the ground-color is yellower than in those of medium and full size.

I propose to call this species *Gyrinophilus maculicaudus*. In its habitat in cold springs it resembles *Spelerpes ruber*, with which it agrees also in color. The *S. longicaudus* is a terrestrial species.

The first specimens of *G. maculicaudus* were found by Mr. E. R. Quick, of Brookville, Indiana.—E. D. Cope.

An Apparently New Species of Chelys.—Only one species of Chelys has been known so far, the well-known fimbriated or bearded turtle, *Chelys fimbriata* Schneid. from South America.

The osteological department of Clark University received lately from Ward's Natural Science Establishment, among other reptiles, a specimen of Chelys in alcohol. The label gave the locality Orinoco. When I examined the animal I found considerable differences from the description and figures given in Boulenger's catalogue.

Boulenger gives as one of the *generic* characters of Chelys, "jaws In the specimen before me (length of shell over curve, 430 mm.; breadth over curve, 376 mm.) there is a very well-developed horny beak, not different in structure from that of other Chelonians. The structure of the skull also showed considerable differences with that figured by Boulenger. In Boulenger's figure the plates end in a sharp angle behind; this region is quite different in my specimen, and agrees exactly with the figure given by Cuvier (Ossem. foss.). But the greatest difference is to be seen in the lower face of the maxillary. In Boulenger's specimen the lower alveolar face of the maxillary at the middle is not broader than the vomer, forming about one-sixth of the breadth of the palate. My specimen agrees with Cuvier's figure; the alveolar surface is considerably broader than the vomer, and forms less than one-quarter of the breadth of the palate. The figure given by Hoffmann is like that of Cuvier. I do not know how the figures presented by Wagler and Bruehl compare with that of Boulenger, having the works of these authors not at hand. It is harely possible that the figure published by Boulenger is incorrect, since all the other new figures in the catilogue are accurate. I can only think that there are two different species of Chelys. The common *Chelys fimbriata*, figured by Cuvier and Hoffman, and agreeing with my specimen, with well-developed horny beak, and an other one figured by Boulenger as *Chelys fimbriata*, which would represent a new species, which may be called, if future examination proves its distinctness, *Chelys boulengerii*.—G. Baur, *Clark University, Worcester, Mass., Oct. 30th, 1890.*

Snakes in Banana Bunches.—Editors American Naturalist: Referring to the item "Snakes in Banana Bunches," in the American Naturalist for August, 1890, I wish to say that nearly two years ago I obtained a snake, brought to this city in a bunch of bananas. It being in winter the snake was still alive, though lethargic, and which I identified as a young *Boa imperator*. It is about three feet in length, and is now in the museum of this Society.—J. A. Henshall, *Secretary and Director Cincinnati Soc. Nat. Hist., Cincinnati, September 8, 1890.*

Note by Editor.—Since our item above referred to, two cases of the *Boa imperator* having been found in banana bunches, in Philadelphia, have come under my notice. It is a coincidence that since the banana is believed by some to have been the "forbidden fruit" of the Garden of Eden, serpents should be so readily concealed in its fruit.—E. D. Cope.

The Brain-Weight of Birds.—In preceding pages of the AMERICAN NATURALIST (see Vol. XXI., p. 389, and Vol. XXII., pp. 537–539) I have given my results attained by an investigation into the relative weight of the brain to the body in birds. As an addition to the ones already given I have made the following new relative weights:

Name of Bird.	Weight of Body.	Weight of Brain.	Sex.	Relative Weight of Brain to Body.	Date Specimen was taken.
Spizella monticola.	299	12¾	♂	1-23	Mar. 15, 1889.
Junco hyemalis.	310	12¾	♂	1-25	" "
" "	282½	11¾	♂	1-24	" "
Melospiza fasciata.	343	14	♂	1-25	" "
Troglodytes hiemalis.	145	9	♂	1-16	" "
Parus atricapillus.	184	11	♀	1-17	Mar. 23, 1890.
Sialia sialis.	628	15	♂	1-42	" "

The above weights are given in grains, and the specimens were taken at Chicago, Ill.—DR. JOSEPH L. HANCOCK.

Zoological News.—Vertebrata.—Sir William Turner has had an opportunity to study the placentation of dugong. He finds,[7] contrary to Harting, that the placenta is zonary, and probably is non-deciduate. His material was older than that of Harting.

J. S. Kellogg has studied the development of the primitive kidney of Amblystoma. In his preliminary paper [8] he finds that the pronephric duct is first to be formed, and, contrary to what has been described in other vertebrates, this arises not from the ectoderm, but from the somatic portion of the mesoderm. The tube is cut off from the rest of the cœlomic epithelium except at two points, where the connection persists as the nephratomes. With growth the funnels and their ducts become greatly convoluted.

[7] Proc. Roy. Socy. Edinburgh, XVI., p. 262.

[8] Johns Hopkins Univ. Circ., IX., p. 59. 1890.

ENTOMOLOGY.[1]

Entomology at Indianapolis.—The attendance of entomologists at the recent meeting of the A. A. A. S., while not as large as could be wished, was fully up to the average. We give below abstracts of a number of the papers read, while several others are reserved for future discussion. The first three following were presented before the Society for the Promotion of Agricultural Science, while the remainder were read before the Entomological Club of the A. A. A. S.

INSECTS PRODUCING SILVER-TOP IN GRASS.—Professor Herbert Osborn, in an excellent paper, said the "silver-top" in grass is a whitening of the upper portion of the stalk, especially the head, which withers without maturing seed. Meromyza, Chlorops, and Thrips have been credited with being the cause of the mischief. Professor Comstock has shown that *Limothrips poaphagus* is often the cause. The injury may result from any attack upon the juicy base of the terminal node that cuts off the flow of sap to the head. Fully 90 per cent. of a large number of grass-stems examined contained no insects within the sheath. Many of them did show the punctures of Homoptera, especially Jassidæ, about the upper node, and it is probable that these leaf-hoppers are responsible for much of the "silver-top." These insects are open to general attack, and the injury should be prevented by their destruction.

ARTIFICIAL PASTURAGE FOR BEES.—In a paper on this subject, Professor A. J. Cook reported experiments in planting Rocky Mountain Bee Plant (*Cleome integrifolia*), Chapman Honey Plant (*Echinops spherocephalus*), and a foreign mint (*Melissa sp.*). None of the experiments were successful, and the conclusion is reached that it is doubtful policy to sow any plant for its nectar alone. The best results will probably come in combining nectar secretion with some other useful quality.

FERTILIZERS AS INSECTICIDES.—In a paper entitled Fertilizers as Insecticides and Insecticides as Fertilizers, Prof. J. B. Smith reported the results of some interesting experiments. The author has lost all faith in "repellents." No matter how bad a smell may be created, if it does not act destructively as well, it is useless. All sorts of decaying or decomposing matter is attractive rather than offensive to insects. Barnyard manure has no repellent or insecticidal value. Phosphates

[1] Edited by Dr. C. M. Weed, Experiment Station, Columbus, O.

were used without success, but potash, in the form of muriate and kainit, has proved a valuable insecticide. In the proportion of one ounce to one pint of water muriate of potash destroys plant-lice, mealy bugs, bark-lice, and thousand-legged worms (Iulus,—called by the author of the paper "wire-worms," a misleading term). Kainit gave similar results. Hairy caterpillars, beetles, and bugs are not affected by these substances. Tobacco was also shown to be of decided value, both as an insecticide and a fertilizer.

TEACHING ENTOMOLOGY.—Professor A. J. Cook, in his presidential address before the Entomological Club, discussed the methods of teaching entomology in use at the Michigan Agricultural College. All students are required to make drawings, and to dissect, rear, and collect insects. Reference collections are always within reach. The course of study should include botany, free-hand drawing, French, and German. The address was listened to with marked interest, and some admirable examples of drawing by Professor Cook's students were exhibited.

A WATER-LILY MOTH.—Professor D. S. Kellicott described the life-history of *Eustrotia caduca*. The larva feeds upon the fruit and leaves of *Nuphar advena*. The eggs are placed on the upper side of floating Nuphar leaves in irregular patches of a few in number. They are hemisphericaly 1 mm. in diameter, and with a waxy hue; the surface is beset by about thirty meridianal, nodular ridges. The young escapes by cutting nearly off a round lid which it lifts on a hinge. The larvæ mature in July, and spin delicate white silken cocoons upon the leaves. The imagos begin to issue after a pupal period of eight days.

OVIPOSITION OF THE SAGITTARIA CURCULIO.—Dr. C. M. Weed reported observations showing that the Sagittaria Curculio (*Listronotus latiusculus* Boh.) deposits its eggs, largely during July, in small bunches, usually of between five and ten, upon the leaf and flower stalks of Sagittaria. After being laid they are covered with minute particles of the epidermis of the stalk, chewed off by the parent beetle, and probably fastened together by some sticky secretion. Enough of these particles of epidermis are placed over the eggs to make a conical covering 1.5 mm. in diameter at the base, and 0.7 mm. high. When the larvæ hatch from the small yellowish-white eggs they bore directly into the stem, leaving the empty egg-shells and their protective covering still in place.

OVIPOSITION OF DECTES SPINOSUS.—In describing the egg-laying habits of the Cerambycid beetle, *Dectes spinosus*, Dr. Weed said the

egg in a case observed was deposited obliquely in the pith of the stem of horse-weed (*Ambrosia trifida*). The outer fibres are first gnawed away to allow the insertion of the ovipositor. The egg is 2 mm. long by 0.3 mm. wide, elongate-oval, slightly curved, and pale yellow in color.

LIFE-HISTORY OF EVENING PRIMROSE CURCULIO.—The common borer of the evening primrose has been studied with some care by Dr. Weed, who reported finding a freshly-emerged adult *Tyloderma foveolatus* in an Oenothera stem, July 22, 1890. This was early, as the main brood develops during August and September. The beetle hibernates in the adult state, the sexes mating early in June. The full-grown larva is 8 mm. long by 2.5 mm. wide, the body, including the thin cervical shield, being white in color, while the head is light brown. The pupa is 7 mm. long, white, and of the normal curculionid form. Pupation takes place in the larval burrow within the stem. Besides *Oenothera biennis*, the insect develops in *Epilobium coloratum*. It is attacked by an external parasite, a species of Bracon.

LIFE-HISTORY OF LIXUS CONCAVUS.—Dr. Weed also reported rearing *Lixus concavus* in numbers from the stems of a common dock (*Rumex crispus*). The larva bores the stem and upper portion of the root, pupating about midsummer, and soon after emerging as a beetle. The larva is attacked by an external Braconid parasite.

OFFICERS ELECTED.—The following officers were elected by the Entomological Club for the ensuing year: President, Professor Herbert Osborn; Vice President, Miss Mary E. Murdfeldt; Secretary, Dr. C. M. Weed.

Crayon Drawing for Photo-Engraving.—The editor of this department has received so many queries concerning the methods and materials employed in preparing the drawings that have lately appeared in the Bulletin of the Ohio Experiment Station, and also in this department of the NATURALIST, that Miss Freda Detmers, by whom they were made, was requested to furnish a brief statement of the main points involved. She has kindly done so, with the following result: "The materials to be used are (1) ordinary bristol board or other stiff white paper; (2) a hard drawing pencil, a 5 H. Faber does very well; (3) a good quality of tracing paper, oiled on both sides; (4) a supply of different grades of the Ross special process stipple drawing paper; (5) Faber's black wax crayon pencils, No. 41; (6) a good black India drawing ink, such as Higgins's water-proof American India ink; (7) Gillott's lithographic crow-quill pens, No. 659. Having these materials,

the process of drawing is simple. My usual method is in the case of bisymmetrical insects to measure carefully with a pair of good dividers the length of the insect, transferring the measurements to a piece of paper, and drawing a straight line between the two end points. Then measure the length and breadth of every part of half of the insect, and locate these points on one side of the line. When the outline of half the insect is satisfactory, trace it, straight line included, on the transfer paper. Now reverse the transfer paper, placing the traced outline on the opposite side of the straight line, and rub over it with some hard point,—the point of a lead pencil, for instance. Remove the transfer paper, and the outline of the whole insect appears. This completed outline is then transferred by means of tracing paper to the special process stipple paper, and the drawing proper is made with the wax crayon. Pen and ink is used occasionally to indicate fine hairs, etc. Many beginners make outlines in ink, where simple crayon outlines would be better. It is important to keep the black and white points distinct, not blending them by rubbing."

To this it may be added that all drawings should be reduced about one-third or one-fourth, *i. e.*, to two-thirds or three-fourths the size of the drawing. The engraving should be done by a good establishment. It does not pay to have the cheap processes of zinc-etching, etc., tried on good drawings. Many engraving establishments return soft metal cuts, in which case they should be saved as originals and electrotypes made from them.—C. M. W.

PSYCHOLOGY.

Jastrow on a Writing Test.—In a paper entitled "A Study in Mental Statistics," Prof. Jastrow describes the results of a mental test in which fifty students of a class in psychology, at the University of Wisconsin (twenty-five men and twenty-five women), took part. The task consisted in writing 100 words as rapidly as possible. The material thus collected was utilized to shed light upon (1) the similarity of our ideas and habits of thought, (2) the links that bind our ideas together, and (3) the time required for these processes.

(1) The general tendency to regard one's mental habits and products as singular and original, and consequently to look upon every evidence of similarity of thought as a strange coincidence, receives a set-back from the result of the present and similar studies, for it is found that

these fifty persons, independently writing one hundred words from the many thousand with which they are acquainted, all in all, select from the same 2,024; *i.e.*, of the five thousand words written only 2,024 are different. Again, 1266 words occur but once in the aggregate lists, and omitting these we find that about three thousand of the words are formed by the repetition of only 758 words. Passing to an analysis of this "mental community," it becomes clear that it is greatest at the beginning of the list, and becomes less towards the end; *i.e.*, the habit is to write first the most common, and when these are exhausted, the more unusual words. A very interesting point is the comparison of men and women in their tendency to repeat one another's thoughts. The evidence is unmistakable that the lists of words drawn up by the women are much more like one another than are those written by the men. The women use only 1,123 different words, the men 1,376; the women write but 520 words that occur but once in the lists, the men write 746 such words.

(2) A study of the processes involved in these lists bases itself upon a careful analysis of the ideas therein represented. The relative sizes of such classes, in a measure, indicate the prominence of different classes of objects in the minds of the writers. It may be interesting to mention that the five best represented classes (of the twenty-five adopted in the paper) are "Names of Animals," "Articles of Dress," "Proper Names," "Actions," "Implements and Utensils." The sexes present characteristic preferences for the various classes. The women contribute most largely to "Articles of Dress," writing 224 such words, while the men write but 129; they show an equal favoritism for "Articles of Food," writing 179 such words to but 53 for the men. The men, on the other hand, show fondness for "Implements and Utensils," "Names of Animals," "Professions," "Abstract Terms," etc.

Of the various links by which the one word suggests its successor, it may suffice to indicate as prominent types, (*a*) association by sound, in which words are rhymed, or begin with the same letter; (*b*) by belonging to the same class, as when a series of animals or articles of dress is formed; and (*c*) by more general but not briefly describable relations. One may combine the two inquiries (1) and (2) to ask how often the same word is associated with the same word in different lists. If we take the twenty words most frequently occurring, we find over 500 mentions; and if we examine in each case the word preceding the given word we find it to be the same in 111 cases, and the succeeding word the same in 145 cases,—certainly a remarkable

result. Here, again, the women are found to repeat one another more than the men.

(3) Regarding the time occupied in the process the result reached is that (roughly speaking) it takes on the average 308 seconds to write such a list of 100 words; that 210 seconds are consumed in the mere act of writing, 114 seconds in thinking of what to write, and 16 seconds in which both may be done.

These results are offered, in addition to whatever value they may possess, as an illustration of how, by simple experimental methods, we may become more intimate with the processes that we constantly but unconsciously perform.

ANTHROPOLOGY AND PREHISTORIC ARCHÆOLOGY.[1]

Anthropology of the American Association for the Advancement of Science, at Indianapolis.—The American Association for the Advancement of Science held its thirty-ninth meeting at Indianapolis, Indiana, beginning on Tuesday, August 19th, 1890, and continuing ten days. The meetings were held in the new State House, where were also the offices of the Local Committee and Permanent Secretary. This meeting was the fiftieth anniversary of the organization of the Association of Geologists and Naturalists, the parent of the A. A. A. S., which added greatly to its interest. Indianapolis, with its wide, well-shaded streets, its large, comfortable hotels, and the unusual accommodations afforded by which all the sections could meet in large halls under one roof, made this the most important meeting ever held in the West. The Local Committee are to be commended for their admirable arrangements for the comfort of the large number of members and their friends.

The department of Anthropology held its meetings in the Hall of Representatives, with Dr. Frank Baker, of Washington, D. C., as president, and Prof. Joseph Jastrow, of the University of Wisconsin, as secretary.

The address of the President of the Section was listened to with much attention, and created much interest. Dr. Baker is professor in the Medical College of the Georgetown University, lecturing on human anatomy, and is well qualified to speak as he did upon the "Ascent of Man." His arguments were in favor of the theory of

[1] This section is edited by Dr. Thomas Wilson, of the U. S. National Museum.

evolution of the species, and his facts were derived from the changes wrought in the anatomical structure of man. The theory was that those elements or peculiarities of the bones and muscles of man which by reason of his changed condition from brute to man, from quadruped to biped, were not used, have largely disappeared, and nothing is now found but the vestiges, while those which in the changed condition were more used grew and strengthened and became the new elements as we find them, but showing signs of their recent origin. He said, comparing the human hand with that of the anthropoids, its greater efficiency has been produced in two ways: first, increasing the mobility of the thumb and fingers; second, reducing the muscles used to assist prolonged grasps, they being no longer necessary. The latest elements ought to show signs of their recent origin, while those going out of use ought to have become vestigial. Of the former are the flexor muscles of the thumb and fingers; of the latter is the *palmaris longus*, used for climbing and grasping. These differences are more clearly manifested in the negro than in the white race. So also the change in the obliquity of the elbow-joint and the axis of the humerus, that the hand can be easier carried to the mouth. This is marked in the white race when compared with the negro, and still more when compared with the anthropoids.

The scapular index is highest in the white races, less in the infant, the negro, the Australians, and still less in anthropoids.

The *epitrachleo-anconeuo*, a small muscle at the elbow-joint, is used in apes to effect a lateral movement of the ulna upon the humerus, but in the white race this lateral motion has been lost, and the muscle has degenerated. A perforation of the olecranon fossa may be regarded as a reversion towards the anthropoids. The doctor continued these illustrations, citing the shoulder-blade, the foot, the great toe, the muscles needed for the erect position of man, the head, the spinal column, the pelvis, the bladder, the liver. The valves of the veins are arranged for a quadrupedal position. Evidently intended to resist the action of gravity, they should, to be effective, be found in the large vertical trunks. But in the most important of these they are wanting. Yet they occur in several horizontal trunks, where they are, as far as we know, of no use whatever. Place man on all fours, however, and it is seen that the entire system of valves is arranged with reference to the action of gravity in that position. The great vessels along the spine and the portal system, being then approximately horizontal, do not require valves; while all the vertical trunks of considerable size, even the intercostal and jugular veins, are provided with

them. A confirmation of this view is found in the fact that the valves are variable in character, and tend to disappear in the veins where they are no longer needed. He concludes, upon surveying the whole field, that this indicates a derivation of the vertebrates from some form of the annelid worms, among which a single unit produces by successive budding a compound longitudinal body. This view is fully confirmed by the behavior of the human embryo. In the spinal column of the human embryo thirty-eight segments can at one time be made out. Four or five of these generally disappear, but cases are by no means wanting in which they remain until after birth, and constitute a well-marked free tail. In one case, carefully examined and described by Lissner, a girl of twelve years had an appendage of this character 12.5 centimetres long. Other observers, probably less careful and exact, report much greater lengths. From some observations it would appear that abnormities of this kind may be transmitted from parent to offspring. Dr. Max Bartels recently collected from widely-scattered literature reports of 116 actually observed and described cases of tailed men. In 35 instances authors report such abnormities to be possessed by an entire people, they themselves having observed certain individuals. These cases are scattered throughout the whole of the known globe, and extend back for a thousand years.

At first man's skull seems to be much simpler than the typical form. The bones are fewer and less complicated. But follow back the course of development, and we find the bones separating,—the frontal into two pieces, the occipital and temporal each into four, the sphenoid into eight, repeating what we find as we descend the vertebrate scale. The capacity of the cranium is usually held to distinguish man, yet the lowest microcephali approach to the apes in this respect, and the lower races have unquestionably smaller brains than the higher. As far as can be judged, there has also been an increase in average capacity during historic times.

"The Indian Origin of Maple Sugar," by Mr. Henry W. Henshaw, of Washington.—The point was as to whether the Indians learned to make sugar of the whites or vice versa. The argument drawn from the maple-tree festivals and linguistic evidence showed the red men were in no way indebted to the whites for sugar, no more than for the cultivation of corn, the pumpkin, bean, and tobacco. Their simple process was aboriginal, resulting from their own observation and inventive powers. They collect the sap in birch-bark vessels. These hold in some cases a hundred gallons. They take advantage of cold April nights to freeze the sap, and in the morning throw out the ice.

They evaporate it by throwing hot stones into the reservoirs of sap. The sugar is eaten mixed with corn. Sometimes the pure sugar is their only diet for a month. They boil venison and rabbits in the hot sap as they evaporate it. They also make sugar from the silver maple and box elder. That the Indians made sugar from times unknown is proved by their language, their festivals, and their traditions. Several authors of early times, telling af their visits to the Indians, mention maple sugar, and one of them, in 1756, describes the Indian's mode of preparing it. The gathering of sap and making of sugar formed one of their annual religious ceremonies.

"Fort Ancient, Ohio," by Mr. Warren K. Moorehead.—Mr. Moorehead spent two summers in excavating the mounds and studying the topography of Fort Ancient, on the Miami River. He has shown as much energy in digging out Fort Ancient as Schliemann in excavating Troy. As an indirect result of his labors, the Legislature of Ohio authorized the purchase of the fort and surrounding ground as a State park. A map of Fort Ancient, together with a short notice of Mr. Moorehead's work, was published in the American Naturalist, April, 1890, p. 383. His book on that subject, just published, which has already passed its second edition, gives a complete account of this great prehistoric earthwork.

The fort is really two, the old fort and the new fort, connected as by an isthmus. Each fort has about an acre and a-half of ground, and the two resemble in general shape North and South America, with their connecting isthmus. The cemeteries, from which over two hundred skeletons have been removed and measured, reveal two classes of people, two kinds of implements, and two varieties of pottery, plain and ornamental. The village seems to have been occupied for three periods, and each period of occupancy lasted for many years. Four feet below the present surface there are occasionally a bed of ashes or a mass of burnt rock, around which and in which occur large numbers of perforated mussel shells, bone awls, shells of the land tortoise, pottery fragments, flint chips, hammer stones, etc. Then there are about two feet of earth, which may have been deposited in a freshet, or slowly accumulated during a period of one hundred or more years that the ground was unoccupied. Following this is a second layer, heavier, while the third or upper stratum is but one foot from the present surface.

The preservation of minute bones, fragile shells, and perishable objects is due to the ashes, of which there were many bushels.

There is a spot in a field within a half a mile of the new fort,

situated upon the plain where it commands a view of the enclosure, upon which were manufactured arrow-heads of quartz. Quartz is not frequent in Ohio, and we have never found it except in isolated specimens; its presence indicates that a distant tribe was present when these chippings were deposited.

On the village site in the old fort, and upon that near the Little Miami River, we found thousands and thousands of pottery fragments, some of them decorated in a similar manner to those at Madisonville. In the bottom of the ditches outside the fort, and in the fields bordering the fort upon the east side, we find a class of pottery sherds different from those found within the structure. I have upwards of five thousand specimens of pottery of both varieties. Years might be spent at Fort Ancient in excavation of the graves and cemeteries that nearly everywhere are to be found beneath the towering oaks and beeches, and yet there would remain sufficient material to engage the attention of archæologists for a long time to come. Questions all unsolved present themselves at every step. For instance, the age of Fort Ancient,—was it constructed all at one time or in epochs? The races of people who constructed it,—who and what were they? The civilization and social surroundings which required such a work, the terraces, the ravines, the timber in the walls, the gateways, the huts, the mounds, cemeteries, etc.

This great enclosure, so rich in facts, so productive of implements that tell us of the every-day life of the ancient people who lived within its walls, may yet reveal to the patient investigator its history, and dispel the darkness that surrounds the origin and movements of ancient men upon the American continent. It is to be hoped that every aboriginal structure in the United States will become the property of the Government, or of some institution which can preserve, explore, and beautify it.

Mr. W. H. Holmes, of the Bureau of Ethnology, Washington, D. C., read a paper on the "Aboriginal Stone Implements of the Potomac Valley." He has lately investigated the steatite quarries around Washington, and found the aboriginal vessels in their rudest stages of manufacture, also the implements with which they had been made.

He described his work among the quartzite bowlders on Piney Branch, near Washington. The impression of Mr. Holmes's paper, and the discussion following it, is thus told in one of the Indianapolis journals of the day:

"Hence the rude forms of chipped stones are not tools at all, as has been taught by archæologists for half a century, and so the 'rough

stone age' and the 'smooth stone age' of the District of Columbia and all the rest of the world are knocked into smithereens. This is not Prof. Holmes's exact language, but that is just what he meant.

"Professor Holmes will pick a few bushels of flint bowlders out of Pogue's run, and by knocking one against the other can in a few hours leave evidences of the poor old 'Paleolithic man' scattered all over the capitol grounds. By finishing up his flint stones into good shape —arrow-heads, knives, skinners, etc.—he can prove that the Old Paleolith was followed by the Indian races. This knocks some dear old theories in the head, and particularly sets the French archæologists in the background.

"Professor Putnam, who knows all about it, observed exactly the same thing along the shores of Cape Cod several months before, and says the French have played the deuce with this ancient and honorable science, and that their 'effort to classify our ancestors on the form of their stone implements is no better than the matching of brass buttons.' 'Primitive man,' said Professor Putnam, 'made only a cutting-edge on the bowlders. The Indian went further and made knives and perforators, and that is all there is of it. The many divisions based on the shape of the implements is artificial and of no value.'

"Dr. Mason, the creator of the National Museum, did not like to see the 'French archæologists given such a black eye by Prof. Putnam,' but he placed a high value on the views of Mr. Holmes, which are accepted in this country almost universally. Mr. Holmes can make Indian arrows out of a beer-bottle, a piece of cannel coal, or anything that has a shell-like fracture. All he uses is a piece of hide to protect the hand, and a piece of deer antler or an iron nail to press off the flakes of flint. He can give pointers to Hiawatha's ancient arrow-maker, as he is not limited to jasper and chalcedony, but can shape them deftly out of almost anything except punk and dried pumpkin."

"The Brains of a Man and a Chimpanzee Compared," by Prof. Burt G. Wilder, of Cornell University.—Four large diagrams were displayed for the comparison. The fissures and contortions of the two brains were shown and commented upon, and the paper stated that the resemblances were numerous and impressive. "Indeed, if one were to look simply at the middle aspect of the two brains only, it would hardly be safe to affirm that one organism is the habitation of an immortal soul and the other one of the 'beasts that perish;' that the one was made only a little lower than the angels, and the other only a little higher than the monkeys."

Prof. Cope continued the comparison of the human brain and the chimpanzee's brain, being especially struck with the smoothness of the great convolutions in the brains of the lower types of men, in which they resemble the other mammalia. These, he said, are characters that cannot be remedied in any brief space of time,—perhaps cannot be remedied at all. These differences in the brain involve social and political questions.

"The brain structure we find in Indo-European races has required centuries to develop. We are now confronted in this country with the mixture of two races,—an inferior race which has never done anything with a superior race of later origin. The question is, Are we going to permit it? I believe we should follow the law of self-preservation, and should oppose and resist hybridization. We have before us a problem of race depreciation, and statesmen and reformers should study the question as Professor Wilder has studied it."

Dr. J. A. Houser, of Indianapolis, continued the discussion, saying that "the American people need have no fear of a race whose front brain lacks fifteen cubic inches of brain stuff as compared with the average. The superior cerebral convolutions of the brain have made the laws and governed the world. In all kindness and charity, the higher intellect should stoop down and say, 'I will help you, but you shall not control me.'"

The discussion continued into the next paper, which was by Mr. J. Muller: "The Peculiar Effects of One-Sided Occupations on the Anatamy and Physiology." Prof. Cope said: "The subdivisions of the higher races of men based upon the features of the face are of little value; in the lower races the divisions based on such peculiarities are more constant. Deep-seated anatomical characters are not easily altered by occupations; only superficial characters are so altered. A man with a flat shin bone is nearer the ape in relationship than a man with a triangular shin bone. A man with a tritubercular teeth is in that degree further from the ape. The shin bone, the tubercles, and the hyoid bone have characters which are not soon eradicated, and whose significance must not be forgotten. The tendency of the two last bones of the little toe to unite is a sign of advancement. The little toe is, in short, going out of existence. The man whose little toe-joints are anchylosed is a further remove from the ape. In the Hottentot, on the contrary, we have anchylosis of the bones of the nose, relating him to the lower primates. The science of paleontology comes in play here and gives us aid. These characters, like the flat shin bone and the smooth brow, are not easily overcome. They are deep-seated. We

should exert ourselves to get rid of them, but not so fast as to depreciate the higher races."

The bearing of Prof. Cope's remarks was that important natural differences in races should have their weight in social life and politics.

Prof. Jastrow, of the University of Wisconsin, called attention to the distinction between characteristics relating to functions and activities during life and those observed upon the body after death. While the former may be very important and easily noticed in every-day life, the latter are those most in use by anthropologists for race distinctions. The former are modified in a relatively short period; the latter are relatively fixed, and are modified with extreme difficulty. The former are physiological, the latter anatomical; and it may be said that it takes a long time for physiology to be converted into anatomy.

Prof. O. T. Mason, of the Smithsonian Institution, read a paper on "The Arts of Modern Savages as a Means of Interpreting Archæology." He cited the walrus and other animals engraved on horn and ivory by the Esquimaux. A century ago they engraved with flint points; now they have steel knives, and their work is much superior to its former state. The art capacity of the people has not improved; the tool has improved. Such work must not be cited to a wrong purpose. By studying the work of present savage races under the varying conditions of contact with civilized races, much light may be thrown upon the development of races. "There is an apparent millennium among the archæologists here to-day," said Professor Mason; "we are holding an apparent love-feast, but we really represent two hostile camps. Some of us believe the tools found and the mounds and forts all over the great West were made by Indians. There are others here who believe these great works, built without the use of iron, were made by a people of another race,—the mound-builders, whom the Indians have followed. Much light may be thrown on this subject in the next five years. How shall we understand and interpret the tools, the dress, the habits, the houses, the laws, the social life, the religion, the folk-lore, of these ancient American peoples, whether they are Indians or mound-builders? That is for us to do, and the humblest may do their part. Collect all the facts, and the truth will at some time be interpreted."

Who were the Indians and the mound-builders? Has America been peopled by three different races,—mound-builders, Indians, and Caucasians,—driving off each other in succession? Or were the Indians and the mound-builders one and the same people? These are the questions which are considered by American archæologists of to-day.

Prof. Putnam, of Harvard, said regarding the "two hostile camps": "For my part, I do not regard either Indians or mound-builders as scientific names. The word Indian was a misnomer, as we all know, —an error not of the early navigators but of Columbus, who mistook the West Indies for the East Indies, and called the people Indians, a word now used for the aboriginal people of every country; even Australian Indians are spoken of. For my part, I believe the early inhabitants of America were of several stocks. I like the word 'stock' in this connection. There was a short and round-headed southwestern stock, as the Zuñis; there was a long-headed northwestern stock; also the Eskimo of the Arctic regions, and the Caribs of the West Indies. Of course these graded into each other and mixed, but the central types are distinct. These various peoples of the past comprised the so-called mound-builders and Indians. These are my views, and I do not stand entirely alone. The Harvard camp and the Washington camp have no other desire than to find the truth."

Prof. Putnam gave an elaborate description of his discovery of "A Singular Earthwork Near Foster's Station, in the Little Miami Valley," about twenty miles north of Cincinnati. Prof. Putnam was assisted by Dr. Hilborn T. Cresson, Messrs. G. A. Dorsey, M. H. Seville, and Ernest Volk, all of the Peabody Museum. A series of drawings and photographs were used in illustration. Prof. Putnam had also several bushels of cinders, burnt limestone, charcoal, and ashes dug from the earthwork. "This mound," said the professor, "is in the angle of a creek and the river. It is a flat-topped, circular hill, about one-half mile round at the rim,—such a hill as is frequently found at the intersection of a creek and river. It is made by the river and creek washing away the drift material on either side. Such hills command the valleys as lookouts, and are often fortified. Around the brow of this hill is a ridge in some parts; at others it is not elevated above the surface. This ridge is made up of well-burnt clay, and includes masses of burnt limestone, clinkers, charred logs, and heaps of ashes, from a bushel to forty bushels in bulk. This strange circular rim is over half a mile long, twenty to fifty feet wide, and eight to ten feet deep. To have burnt all this clay must have required a heat like that of a Bessemer furnace. Another strange feature is that the rim of burnt stuff is backed by an escarpment of well-laid stone wall, to keep the burnt material in place. This stone wall probably extended down to the water, but the creek has worn its way down and away from the wall. We have cut through the burnt wall in several places, and shall penetrate it in others. No bones and but a few pieces of pottery have

been found. The fires could not have been those of charcoal pits, nor was it a lime-kiln. There must have been an immense amount of fuel collected to burn this mass of clay and stone." The theory of cremation was discussed, but if these are crematories it is quite remarkable that no bones or remnants are found.

MICROSCOPY.[1]

Demonstration of the Chromosomes.[2]—In the preparation of the egg for tracing the history of the nuclear elements, Boveri employed two methods. In one, the preservative fluid was a mixture of picric and acetic acid, and the staining fluid borax-carmine; in the other, which was the principal reliance, Schneider's acid-carmine served both as a preservative and staining medium. The living egg is followed under the microscope until the desired stage is reached; then a drop of acid-carmine is added at one side of the cover-glass, and drawn under by the aid of a bit of filter-paper applied at the opposite side. After 5-30 minutes the fluid is replaced by glacial acetic acid, which decolorizes all parts of the egg except the chromosomes, and at the same time renders the cytoplasm quite clear, while giving a sharp definition to the chromatic elements. The achromatic elements are not well preserved.

The egg so prepared is mounted in glycerine. In order to determine the exact number of chromosomes it was often found necessary to press the egg more or less, and thus separate the chromosomes a little. These preparations last for only a few days.

Caryokinetic Figures.[3]—Dr. Solger calls attention to the fact that the amnion of the rat is more convenient material for exhibiting the caryokinetic figures than the mesentery of the young rabbit (recommended by Orth in his "Cursus der Normalen Histologie"). The advantage of such material is that it can be prepared without the necessity of imbedding and cutting.

The freshly-excised uterus horn is placed in *a saturated aqueous solution of picrid acid*, and then the egg-membranes—at least the chorion —is cut open with scissors. The amnion (of embryos 1.8 cm. long to 2 cm. long) then floats as a very thin membrane, or as a closed sac still envelops the embryo.

[1] Edited by C. O. Whitman, Clark University, Worcester, Mass.

[2] Boveri. Jen. Zeitschr. XXIV., 2 and 3, 1890, p. 319.

[3] B. Solger. Arch. f. mik. Anat.. XXXIII., 4, p. 517, 1889.

After 24 hours the preparation is washed and placed in 70 per cent. alcohol, which is then gradually replaced by a higher grade. For staining, Ehrlich's acid hæmatoxylin, diluted with half its volume of water, is used for five minutes.

Flemming's fluid, followed by saffranin, also gives excellent preparations.

Direct Division of the Nucleus.[4]—Platner avows his conviction that the nucleus does divide, in some cases at least, without any caryokinetic phenomena. This fact, according to Platner, is clearly shown in *malpighian tubes* of insects (e.g., Dytiscus). The gland-cells are very large, and their nuclei are often three or more times the diameter of the nuclei in Triton cells. The tubular organs can be examined in toto without the trouble of imbedding and cutting.

Kleinenberg's picro-sulphuric acid is recommended for hardening, and borax-carmine for staining.

Spermatogenesis in the Hermaphrodite Gland of Limax agrestis.[5]—Platner recommends the following method of preparation for the reproductive elements in Limax:

The fresh hermaphrodite gland is placed in the stronger Flemming's fluid for one hour; then three to four times its volume of water is added to the fluid, and the object left 24 hours. The preparation is then washed in the manner described by Flemming, and passed through ascending grades of alcohol.

The following hæmatoxylin solution gives the best stain for the neben-nucleus:

Hæmatoxylin	1 g.
Alcohol absol.	70 g.
Aq. dest.	30 g.

To be kept in a dark bottle.

The object is stained in toto 24 hours; then decolorized in a 1% alcoholic solution of bichromate of potash. For this purpose a solution of 10 parts of bichromate of potash in 300 parts aq. dest. is kept on hand, from which 30 ccm. may be taken each time for use, and mixed with 70 ccm. 95 per cent. alcohol. The fluid should be kept in the dark during the process of decolorizing, which may require from 12 to 24 hours.

The object is next placed in 70 per cent. alcohol, and kept dark for one or more days. Then follows absolute alcohol, cedar oil, and imbedding in paraffine.

[4] Platner. Arch. f. mik. Anat. XXXIII., 1, 1889, p. 145.
[5] Platner. Arch. f. mik. Anat. XXXIII., 1, 1889, p. 126-7.

Conjugation in the Infusoria.[6]—Lack of material has hitherto been the chief difficulty in the way of thorough study of the phenomena of conjugation. Investigators like Balbiani, Stein, and Bütschli have complained of the rarity of this state, and have explained their incomplete and fragmentary observations on this ground. The subject itself is extremely complex, and requires, as a first condition of successful study, most abundant material.

Thanks to Maupas, we now know how to supply this need. Take stagnant water containing algæ, confervæ, debris of dead leaves, and other vegetable matter, and keep it in dishes covered with glass plates, to prevent evaporation and to guard against dust, until putrid fermentation sets in. Infusoria contained in this water, finding abundant nourishment, multiply in great numbers. When they become abundant they may be taken up in a drop of water and kept on slides in damp chambers, as before described.[7] The infusoria continue to multiply until the supply of food fails; *hunger then leads them to conjugate.*

When rare species are desired, which do not multiply rapidly in small aquaria, two individuals from different sources may be isolated, and made to multiply on slides kept in damp chambers. Mixture of specimens from the two slides, when the food-supply is exhausted, usually results in conjugations.

The isolation of groups of infusoria on slides offers still another important advantage: it enables one to examine them easily with the microscope, and thus to catch the first conjugations.

Maupas calls attention to the fact that, as a general rule, conjugation is most frequent towards the end of night and during the early morning hours.

In beginning the study of a new species the first thing to determine is the duration of the period of conjugation. This point ascertained will serve to guide the course of investigation. The isolation of couples in conjugation is indispensable to the study of the phenomena following separation.

For killing isolated couples at successive hours, in order to trace the history of the nuclei, Maupas recommends corrosive sublimate (1 : 100) as the best reagent. He proceeds as follows: The infusoria are taken up with a pipette and placed in a drop of water on a slide. Fine hairs, suited in thickness to the species under study, are then placed on either side of the drop, as supports for the cover-glass. The in-

[6] Maupas. Arch. de Zool. exp. et gén., 1889, No. 2, p. 168.

[7] NATURALIST, April, 1889.

fusoria should be somewhat compressed, but not crushed. The cover-glass is then placed, and the sublimate added as quickly as possible at one side, and sucked under by the aid of a bit of blotting paper at the other side, care being taken not to disturb the cover. After fixation, the preparations are stained with methyl green in two per cent acetic acid, and then mounted in glycerine. In some species it is best to omit staining altogether, as the stain obscures the micronuclear elements.

It is perfectly useless to undertake the study of conjugation without a powerful homogenous immersion objective.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

The American Association for the Advancement of Science, of 1890.—The committee of the A. A. A. S. *on* the International Congress of Geologists has been discharged by a vote of the association at its recent meeting in Indianapolis. It is unnecessary now to inquire into the motives which induced a small number of persons to cause this act to be accomplished by the body of the association which was ignorant of the true facts, or to scrutinize the means employed by the party of destruction; further than to say that neither the president nor secretary, nor (it is believed) the majority of the members of that committee, asked or desired such discharge. In a letter written by Professor Hall, the president, to Dr. Frazer, the secretary, before the meeting, a copy of which was sent to Prof. Stevenson, he says: "I had no personal or ulterior purpose in keeping the committee in existence last year. I believe that several of us considered it better to do so at that time,—and certainly we were not then prepared to say our work is finished, nor are we prepared to say that now. * * * *If the majority of the members agree to it,* I see no objection to *making our final report and asking to be discharged.* I do not think it courteous or becoming in gentlemen of the council of the A. A. A. S. to move the abolition of the committee, and especially men who are not geologists," etc., etc.

Upon learning, after the meeting, that it was reported there that he had authorized his signature to be attached to a paper asking for the discharge of the said committee, Prof. Hall wrote: "I have never signed nor authorized any one to sign for me any paper whatever, except to you [the secretary] and for your report. I sent a copy of my letter to you * * * to Professor Stevenson, and wrote him giving my rea-

sons *why there should be a final report before disbanding.* I am writing now only to say that no one except yourself has had any authority to sign my name to any paper of any kind whatever."

The present state of things suggests an inquiry into the American committee "*of*" and "*on*" the International Congress of Geologists.

In tracing out the history of a body like the American committee it is essential to bear in mind that the conditions which accompanied its birth in the A. A. A. S. are not those under which a formal deliberative body gestates and nourishes its offspring.

If such a body be on the point of doing some inconsistent act, it has usually many sons skilled in precedent, parliamentary rule, and the history of the particular case to restrain it. The executive acts of the American Association for the Advancement of Science are generally crowded into a short time, and must be settled by a large and heterogeneous crowd of persons, many of whom understand but vaguely what is proposed or why it is proposed. It must also be admitted that the multifarious duties of the permanent secretary, and his invariable condition of overwork during meetings render it impossible for him to guide the actions of the large organization, with its many motions relating to minute details of its work, clear of inconsistencies.

The general secretary is changed annually, and the incoming officer rarely if ever can keep track of the business of the last year, still less of two or three years back, without which intelligent action is impossible.

The result of this is inevitable confusion and inaccuracy in the printed records of the association, abundantly illustrated in the history of this committee, as I have to some extent pointed out in the preface to the reports for the London session.

What has happened with regard to this committee is as follows:

At the Buffalo meeting of the A. A. A. S., held in 1876, a committee was appointed "to consider the propriety of holding an International Congress of Geologists at Paris during the International Exhibition of 1878."

This committee, consisting of W. B. Rogers, James Hall, J. S. Newberry, T. S. Hunt, C. H. Hitchcock, and R. Pumpelly, elected Prof. Hall, chairman, Dr. Hunt, secretary; added to its number Prof. Huxley, Dr. Otto Torrell, and Dr. E. S. Van Baumhauer; not only considered but decided upon the propriety of having such a congress, and went straight ahead to secure it.

This committee, in reporting at the Nashville meeting, calls itself "a committee to arrange for an International Geological Exhibition

and Congress," and gives in detail the plan which it sketched, and which was afterwards followed by the Paris committee of organization. A somewhat humorous feature was the adoption of the following extraordinary resolution on recommendation of the standing committee of the association.

"Resolved, that in addition to the names of Prof. A. C. Ramsey, Director of the Geological Survey of Great Britain, already added to the International Committee, the president for the time being of the geological surveys of France, London, Edinburgh, Dublin, Berlin, Belgium, Italy, Spain, Portugal, and of the Imperial Institute of Vienna be requested to form part of our commission." That is, from the American Association point of view, these persons, although they were not members of the American Association, were asked to take part in the inquiry into the propriety of holding an International Geological Congress, for which the preparations were a long way towards completion, which was to be held, and actually was held, during the next year.

The A. A. A. S. was never asked further to sanction a congress; but in 1877 Prof. Ramsey and most of the foreigners above were added to the committee "by the standing committee."

The opening pages of the Paris volume show how this committee was looked upon there. It is said: "At the termination of the World's Fair of Philadelphia, in 1876, there was formed at Buffalo a committee for the organization of an International Geological Congress at Paris in 1878." Not a word is said of the American Association, but the names of the committee above immediately follow under the heading of the "comité fondateur." This comité, it is said, appealed to the Geological Society of France, which in turn called upon its council to constitute a committee of organization.

The council responded by naming thirty-three Parisian savants. The first act of this committee of organization was to declare that provisionally the following should be deemed a part of the council of the congress:

1st. The members of the comité fondateur.

2d. The members of the committee of organization.

3d. The members of the congress who were actual presidents of French or foreign geological societies and directors of large geological surveys.

In the opening address of the president, M. Hébert (Paris volume, p. 24), he thus alludes to the initiation of the congress: "The initiation of this congress, you are aware, is not due to France. Certain

authoritative voices have been raised to proclaim the necessity of one, but it is to our eminent colleagues assembled in Philadelphia, in 1876, that all the credit is due."

M. Jannettaz, the general secretary, who followed the president, remarked: "It is in Buffalo, as the president has just told us, at the end of the exposition of Philadelphia, that the savants of diverse nationalities, and of a large representation in the history of modern geology, agreed to institute the first International Geological Congress; they were of the unanimous opinion that the congress could be held in Paris during the continuance of the Exposition Universelle. They created in consequence a committee, to which we in France have given the name of the 'comité fondateur,' to recall at once its initiative, and the noble American city which was its point of departure" (Paris volume, 26, 27).

Here, then, was the congress fully started, with no further impulse than the appointment of a committee by the A. A. A. S. for the innocent purpose of "considering the propriety" of holding one. No wonder that the congress regarded the concourse of scientific men in Buffalo as its parent, and never once alluded to the American Association; for the latter had never declared whether it considered the holding of a congress proper or not.

M. Jannettaz goes on to say that the secretary of the comité fondateur, Dr. T. Sterry Hunt, requested M. Tournouër to take the measures which he should judge advisable for the success of the idea.

When the committee of organization was constituted it studied carefully the plan presented to it by the comité fondateur, and issued circulars to carry out the latter's wishes as much as possible.

M. Jannettaz asserts that the programme of this session of the congress was simply an enlargement of the plans of the comité fondateur.

At the Saratoga meeting of the American Association, in 1879, Prof. Hall gave a sketch of the proceedings of the Paris session, and "recommended that the committee be continued." At the same time Dr. Hunt recommended that the foreign members who had been added (Van Baumhauer, Huxley, and Torrell) be released from service on the American committee.

The A. A. A. S. voted both of these propositions.

It seems clear that there is here a confusion between more than one committee, composed of the same persons, it is true, but exercising entirely different functions, and existing by virtue of totally distinct appointments. First, the A. A. A. S. appointed a committee to investigate the propriety of a congress.

This committee, instead of investigating the propriety, and without making any report on the subject of the propriety, actually created and set into operation the congress; which in turn, after being organized, proclaimed the committee's members the "comité fondateur," and one of the constituent parts of the congress's council. With this act the A. A. A. S. had nothing to do, and could neither add to nor take from the comité fondateur its function thus recognized. The only question is whether the congress chose to apply the advantages pertaining to membership in this committee to the original persons who comprised the comité fondateur, or preferred to admit to these privileges all who were named from time to time on the "propriety" committee by the American Association.

The congress's decision on this point is seen in the action which it took during the Bologna session; but in the meantime there is no doubt that as long as the congress does not rescind its act, there exists an integral—the first-named—part of its council, called the comité fondateur, which at this time coincides with the present membership of the American committee.

President Capellini, the editor of the proceedings of the Bologna meeting, opens that splendid volume with a somewhat more accurate statement of the origin of the congress than that given by President Hébert or General Secretary Jannettaz, which he rightly attributes to a motion made in the A. A. A. S., and states the facts virtually as they have been given above. (Bologna Volume, pp. 3, 4, and 5).

But it must not be imagined that because Prof. Capellini inserted into his account of the history of the congress the motion before the A. A. A. S. that he interpreted it differently from MM. Hébert and Jannettaz in the Paris Congress. This is his understanding of the case, given in his presidential address: "At the termination of the World's Fair in Philadelphia a group of geologists assembled in Buffalo constituted a committee for the organization of an international geological congress at Paris in 1878

"The committee created in America took the name of the 'Comité Fondateur de Philadelphie,' to recall its initiative and the exposition which had been the occasion of it."

Again, the committee of organization adopted the following (Art. 5): "The council shall be composed (1) of the members of the comité fondateur; (2) of the members of the committee of organization; (3) of the members of the bureau of the congress; (4) of the actual presidents of geological societies and the directors of large geological surveys; (5) of those members of the congress whom it should invite to sit with it."

This view of the comité fondateur has been adhered to in every one of the four sessions of the congress, held respectively in Paris, Bologna, Berlin, and London.

In all these sessions the congress has called every member of the American committee who happened to be present to a seat in the council (with a single accidental exception), and has thus defined what it means by the "comité fondateur."

To sum up the case: (1) The American Association appointed a committee to investigate a question. Instead of investigating and reporting, it proceeded to create a congress.

(2) The congress created in turn this committee an integral part of its own governing body.

(3) With the organization of the first congress the need of a committee to inquire into the propriety of it ceased, but the American Association practically changed this original "propriety" committee into its representative at the various sessions of the congress, and has been constantly receiving reports from it, and adding to its number for eleven years.

(4) The congress, by its action in receiving all the American Association's additions into its council, has proclaimed that it is not the original members of the comité fondateur at Buffalo, but the membership of the committee representing the American Association before itself that it considers the comité fondateur.

(5) This American committee has further taken the place of the national committees of other countries, and as such has collected information and published reports illustrating American opinion on geological subjects.

It thus appears that the American committee has filled four rôles, the first, or that of inquiry, ceasing as the other three began; and for the proper fulfilment of the three simultaneous functions, which it has been exercising ever since 1878, it is amenable to three independent bodies. That one which may claim priority of age (since the duty of investigation was rendered nugatory by the absolute establishment of the congress) is the congress itself, to which the committee's relations are those of a parent recognized as a member of its household; next is the American Association, for which the committee has appeared in the debates of the congress as a representative; and last are the geologists of North America, whether members of the A. A. A. S. or not, of whom the committee has the right (in view of its past labors) to consider itself the mouth-piece.

In the light of the foregoing facts, it remains to be decided what action this committee proposes for itself in the future.

Shall it, as the national North American committee, set about the

work of preparing a report for the coming meeting of the International Congress in this country? In this case it is to be desired that the work should be commenced without delay, either through the subcommittees already appointed or through others.

Or shall it accept its discharge at the last meeting of the A. A. A. S. as a committee "on," and lapse into the passive glory of the comité fondateur "of" the International Geological Congress, like a soul on which this mortal conception has conferred immortality? Whichever it may decide to do, there is at least one duty of which it cannot divest itself. By virtue of its character as representative of the geologists of North America it has become the responsible subscriber for the edition of the geological maps of Europe assigned to America as to other "great countries." By diligent inquiry it has procured a list of institutions and individuals, together making up the ten thousand francs for the one hundred copies which the map committee in Berlin has agreed to furnish to it. The committee is responsible to the North American subscribers for the delivery of these maps and the map committee in Berlin is pledged to furnish them to the committee. Before ceasing its mortal and commencing its spirit career, therefore, the most elementary considerations of propriety require that it should provide for the fulfilment of this obligation. How this should be done cannot be determined without a meeting of the members of the ex-committee *on*, who might be called together as the existing committee *of* the International Geological Congress.—PERSIFOR FRAZER.

SCIENTIFIC NEWS.

The third session of the Marine Biological Laboratory at Woods Holl was the most successful in the history of the institution. During the winter and spring a large addition was made to the building, giving six additional studies for advanced workers, and affording rooms for library and for lectures. This necessitated other changes. The old library quarters were fitted up for a chemical room, while a dark-room for photographic purposes was arranged. The crying need in past years was a steam launch, and this want has been met by the purchase of a thirty-nine-foot Burgess launch, capable of doing all the work required of it.

The attendance both of students and investigators was larger than ever before. In the department of instruction twenty-six students were enrolled, some coming from the distant States of South Dakota, Nebraska, Kansas, and South Carolina. There were seven present who were beginning investigation under instruction, while fourteen

more were conducting original investigations. Some of the results of the work done will be published at an early date.

During the summer the laboratory purchased four additional lots of land just north of the premises of the U. S. Fish Commission. On one lot there is a dwelling-house, which will be used in future for a mess-house for students and instructors. It is proposed to move the present laboratory to another of these new lots; while on a third, when funds warrant, it is proposed to erect a permanent station at which work can be carried on throughout the year. As a result of these expansions, the laboratory concludes the year with a deficit, but one which is not so large as to occasion serious worry. It is desired, however, to obtain as much aid as possible, and the trustees feel that all the funds should not come from Boston. So far but about one-fifth of all the students have come from Massachusetts; while, on the other hand, Boston has contributed over ninety per cent. of all the funds.

The Western Society of Naturalists will hold its annual meeting this year in the buildings of Purdue University, at Lafayette, Indiana, November 12th and 13th. Dr. C. E. Bessey, the retiring president, will deliver the annual address. A feature of the meeting will be the discussion of natural science as a requirement for admission to college. The secretary of the society is Dr. J. S. Kingsley, of Lincoln, Nebraska.

Howard Evarts Weed, M.Sc., recently a graduate student of the Michigan Agricultural College, has been appointed entomologist and horticulturist of the Mississippi Experiment Station.

Professor S. A. Forbes spent the summer in the Yellowstone Park investigating fish food conditions for the U. S. Fish Commission.

Mr. A. B. Cordley, of the Michigan Agricultural College, has been appointed entomologist of the Vermont Experiment Station.

At the recent meeting of the Society for the Promotion of Agricultural Science, Dr. C. E. Bessey was re-elected president, and Prof. W. R. Lazenby secretary, while Prof. H. W. Wiley was elected to the executive committee. The following gentlemen were elected members of the Society: Prof. L. H. Bailey, of Cornell University; Professors Chas. S. Plumb and W. E. Stone, of Purdue University, and Prof. B. E. Fernow, of the U. S. Forestry Division.

The cotton worm has been recently receiving attention at the hands of Messrs. G. C. Davis and F. W. Malley, the former for the Arkansas Experiment Station, and the latter for the U. S. Department of Agriculture.

L. H. Dewey, recently of the Michigan Experiment Station, has been appointed an assistant in the U. S. Division of Botany.

THE

AMERICAN NATURALIST

VOL. XXIV. NOVEMBER, 1890. 287.

A PICTOGRAPH FROM NOVA SCOTIA.

BY J. WALTER FEWKES.

IN the course of some studies of the language of the Passamaquoddies, made last spring, I was shown by Mrs. W. Wallace Brown, of Calais, Maine, an interesting collection of "squeezes" of Micmac pictographs from Fairy Lake, New Grafton, Nova Scotia. The adornment of the head of several of these interested me considerably, as it seems to impart information in regard to the manners and customs of the Indians who probably made these figures. The cut which is here given is an exact reduction of the squeeze of one of the pictographs to which I refer.[1] The original is remarkable in several particulars, but more especially in regard to the strangely-formed, cap-like figure on the head.

The pictograph considered in this paper is supposed to be an old one, and to have been made by an Indian, probably of the Micmac tribe. Several of the squeezes in the collection appear to have been made after the white man, either by Indians or by the white men themselves. There are representations of ships or vessels with sails, which would point to a modern origin, and one of a human figure with a gun, which cannot antedate the advent of the whites, but there are still others which are so closely allied to other Indian pictographs found elsewhere that they are probably

[1] My figure is an exact copy of the squeeze with all its imperfections. I have never seen the pictograph itself and cannot say whether the breaks in the lines, especially on the body and hair, exist in the original or not. It look as if the squeeze was imperfect at these points.

veritable Indian productions. The occurrence of old and new together is what might be expected. There is an almost involuntary tendency to add one's name to a wall where others have placed theirs. Many examples of this might be mentioned; for instance, Inscription Rock, on the road from Acoma to Zuñi Pueblo, New Mexico, bears side by side Indian pictographs, ancient and modern, and the names and dates of visits of travelers, from the end of the sixteenth to the nineteenth century. The fact, therefore, that there are some modern pictographs associated with the one we are considering does not mean that it also is modern. While the style of the dress might suggest modern times after association with the whites, the remainder of the pictograph has an ancient look which is suggestive.

While it must be confessed that the explanation of these head-dresses proposed in the following lines is conjectural, there is evidence which seems to support it. Evidently these pictographs represent some costume with which the maker was familiar, and can hardly be called fanciful. A pictograph of an Indian with a gun, or a ship with sails, both of which are represented in the collection, affords inherent evidence of the modern origin of the pictograph. It would seem, if the same were not true of undoubtedly ancient pictographs, that the form of the dress of the figure represented in the cut recalled the skirt of the white woman, yet the general character of the pictograph indicates its age, as ancient pictographs with the same form are not unknown. If an ancient pictograph, the form represented in the head-dress must have been a familiar one to the graver. Analogy with other pictographs of known significance, rather than exact knowledge, would lead me to interpret this as a mask or head-dress worn in the dance or on festal or religious occasions.

I have seen at the Indian settlement at Pleasant Point a head-dress ornamented with feathers, which is kept as a curiosity of the olden time; and it is known that in olden time our New England Indians wore such ornaments. Yet I am familiar with but few representations of pictographs of head-dressed ornamented with feathers which are as elaborately delineated as those cut on the rocks of Nova Scotia, of which a cut is here reproduced.

In trying to discover the meaning of this representation I have not been able to satisfy myself that its significance has been correctly, or at least satisfactorily, interpreted. It seems improbable that it was intended to represent a head-dress such as have been taken from the skulls of Indians which have been exhumed at

MICMAC PICTOGRAPH, WITH PROBLEMATICAL HEAD-DRESS.

certain points on the neighboring coast of Maine. While in form it distantly resembles the pointed caps which the Micmacs and Passamaquoddies wore in recent times, it seems but a rude representation of such, and one which an Indian would hardly have sketched in the relative form and size represented.

The interpretation which has suggested itself is as follows: The likeness to a dance-mask or dance-tablet is so close that the possibility of its being a representation of some of the paraphernalia of the dances occurred to me. Familiar with similar masks and elaborate tablets borne on the head by the Pueblo Indians at the present day in several of their ceremonial dances, the likeness of the appendage represented on the head of the Nova Scotia pictograph suggested that it might have a similar sacred importance. It is not uncommon to find dance-masks represented in the pictographs made by the Indians. The pictographs of human faces which one finds in such abundance in the neighborhood of Zuñi Pueblo, New Mexico, often represent those personages who take part in the sacred dances. This is more especially true where human beings are represented, and it is not rare to find heads of *Kō kōs*, of *Sha'la'kos*, and even of the *Ko'yea'mashe*, represented so truthfully that they can be readily recognized. It is not uncommon to find the masks alone of dancers represented, and it is believed that in all such cases there is a certain religious significance in the pictograph, and a sacred meaning in such representations. Such also, it may be surmised, is the meaning of the figure portrayed in the Micmac pictograph. We may have here a representation of an old dance-figure wearing on the head a mask not unlike the masks still carried by the tribes which have preserved to the present day their ancient religious rites. If this interpretation of the head-dress of the pictograph from Nova Scotia is a correct one, as seems plausible, it may give us an insight into the character of the dress of the dancers in ancient Micmac ceremonials.

I have also seen, in the same collection above referred to, pointed rectangular pictographs, with one side inclined to the other, which would also seem to be representations of former head-dresses for use or ornament. Some of these are represented elaborately ornamented with cross-lines, as in our figure, and some are surmounted with feathers, as in the pictograph represented in the cut. Isolated examples of these are often cut on the rocks, while their frequency would indicate that they have a meaning of some kind. We often find in the collection the same rectangular structure on the heads of human figures, but

quite as often the head-dresses are represented alone. It seems hardly probable, if they represent simple caps or hats, that the Indians would take the trouble to cut them on the rocks in the elaborate way in which they occur; but if they represent paraphernalia of the dance one can readily suppose that they would be thus carefully represented.

Moreover, we find among many tribes that the custom of cutting pictographs of dance-masks and other head-dresses which are used in religious ceremonials is a common practice, as any one who has studied the pictographs in the Southwest may attest. I would therefore suggest that in the figure represented in the cut we have a picture of a Micmac wearing a mask possibly worn in sacred ceremonials.

The long appendage to the head is interesting. It is supposed to represent the hair tied up in the ancient fashion. In old times the Passamaquoddy Indians, more especially the squaws, tied their hair on a flat plate, sometimes of shell, on the edges of which were holes through which a string was woven. There is an old folk-tale of the Passamaquoddies in which a string made of eel-skin was used for this purpose. Possibly we have represented in the cut a similar method of doing up the hair formerly used by the Micmacs and Passamaquoddies.

While it is not the purpose of this communication to comment on, much less discuss, the antiquity of the New Grafton pictographs, some of which are undoubtedly modern, it must be said that there are evidences of antiquity in many particulars as far as many are concerned. Through the kindness of Mrs. Brown, I have in my possession the squeezes of several of those which seem to indicate an ancient origin as far as the subject treated is concerned. It is one object of the present communication to call attention to the possibility of gathering some information in regard to the former customs of the ancient aborigines of Nova Scotia, New Brunswick, and New England from the picture-writings which they have left behind. The locality in which the pictograph represented in the cut is found is particularly rich in ancient picture-drawings, and would, I should judge, repay a careful, systematic exploration and study with this thought in mind.

THE EVOLUTION OF MIND.

BY E. D. COPE.

(*Continued from page 913.*)

IN the provision and care for the young animals display a great fertility of resource, beginning low in the scale. It is well known that certain Siluridæ (catfishes), Gasterosteidæ (sticklebacks), and Percidæ (sunfishes) of North America make nests for the reception of the eggs, and that they take care of the young. It is not an uncommon sight, in suitable places in our country, to see the catfish, *Amiurus nebulosus*, lead about its shoal of young fry like a hen with her chickens. Other Siluridæ of South America take the eggs in the mouth, and so protect them. In these and similar cases we may imagine that the animal regards the eggs and young as part of itself, to which it attaches a certain value, as in ordinary self-preservation.

Such an explanation serves in the case of the ants and bees, which show such care of their young. Some of the most remarkable cases of this kind are to be found in the Batrachia Salientia, an order not distinguished for intelligence in any other direction. In some parts of South America and Africa, where there is a dry season, certain tree-frogs deposit their eggs in masses on the branchlets and leaves of trees that overhang the dry beds of streams. The surface of the gelatinous albumen, in which the eggs are enclosed, hardens by evaporation, so that the latter are well protected. On the arrival of the rainy season, the stream below the nest begins to flow, and the nest is dissolved and washed into it, so that the larvæ can pass their branchiferous larval stage successfully. It is interesting to note that the species which adopt this habit are not closely allied in a systematic sense, the African belonging to the Ranidæ, and the South American to the Hylidæ. They have learned the habit independently of each other. Another tree-frog, of unknown species, inhabiting Japan, has been shown by the Rev. W. S. Holland to construct a

similar nest, but of a larger and less solid character. The interior remains semi-fluid, and the eggs hatch and the young pass there a part at least of their larval life before dropping into the stream below. The region is not subject to drought, so that the object of this habit may be to escape enemies which may lurk in the water.

In South America certain Hylidæ (Notrotrema, Opisthodelphys) and Pipidæ (Pipa) adopt the habit of placing the eggs on the back. The former mostly inhabit a region which suffers from drought,—the western slope of the Andes. They retain the eggs in an invagination of the dorsal integument until they are hatched, and in some cases until they have passed their metamorphosis.

In the genus Dendrobates (Dendrobatidæ), also South American, the tadpoles are carried over land on the back of the parent, attached by their mouths, to a new pond, when the old one dries up. The most peculiar modification is that adopted by the *Rhinoderma darwinii* of Chili (fam. Phryniscidæ). The male takes the eggs into his vocal sac, which is entered from the floor of the mouth. This sac is greatly extended in this species, reaching below the entire abdomen. Here the eggs hatch, and the tadpoles remain till such time as they complete their metamorphosis. As in the stickleback and the catfish, this is a case of paternal instinct.

The intelligent efforts of certain birds to divert the attention of enemies from their nests are well known. Two prominent cases of this kind in North America are the woodcock (*Philohela minor*), and the oven bird (*Siurus aurocapillus*). The flutterings of these birds along the ground, apparently in easy reach of the grasp of the pursuer, lead the latter far from the nest. When safety is assured, the bird flies away unharmed. The two species mentioned have no zoological affinity with each other, so that they have adopted the habit independently.

In the capture of prey animals often show a remarkable knowledge of the physical characters of the latter. Thus the ophiophagous snakes seize venomous species by the muzzle, thus keeping their mouths closed and preventing their biting. The wonderful habits of the species of mud-wasps in this respect

have often been observed. They capture the species of insects and spiders which they store for the use of their young by stinging them in the nervous ganglia in such a way as to paralyze without killing them, thus preserving them alive for many months.

The construction of webs by spiders furnishes an excellent illustration of the progressive development of a capacity for mechanical construction. The inferior forms construct loose nets in the grass. Another type adds to this a funnel-shaped retreat, in which they lie in wait. A higher form suspends a triangular net between the branches of a bush, while the perfection of the art is reached by such Epeiridæ as spin a complete disc composed of many triangular segments, which often contains a staircase from the centre, arranged for their ready escape from an enemy. At some early period in the history of the spiders an intelligent perception of the utility of a web in the capture of prey must have been attained. The habit of making the web has become ingrained or instinctive, and has by use absorbed the faculties of the species. Accident has perhaps led to the habits of constructing them differently with relation to the environment, such as the surface of the ground, etc. The triangular form is the simplest possible device for a suspended web, while the discoidal web is constructed by a simple repetition of the same device. This probably means merely increased capacity for web-construction; that is, increased secretion of web-substance, and increased nervous activity, both the result of use.

The intelligence displayed by the higher animals in the capture of prey is well known. I once had a tame raccoon which was fastened by a chain of moderate length in a stable. He frequently attempted to catch the chickens that entered the stable, but was prevented by the shortness of his chain. But he adopted a device which was successful. He collected the remains of his meals within the circle of which his chain formed the radius. He then pretended to go to sleep at a point near the the centre of the circle, while he slyly watched the birds. The latter approached, and, becoming confident, proceeded to peck at the fragments. The raccoon then easily pounced upon and caught them. In the pursuit of their prey dogs, as is well known, display much

intelligence. Some of them anticipate the arrival of deer, which run in a circle, by cutting across its diameter and reaching a point in advance of them. In the same way foxes show remarkable intelligence in their endeavors to escape from dogs in pursuit. They double on their own tracks, and run in water to destroy and confuse the scent. These actions show reasoning capacity of a very respectable order.

The Hymenopterus insects display the most remarkable powers of self-preservation and protection through social organizations. This intelligence was probably reached at some early geologic age, and it has been followed by remarkable consequences, both to themselves and to other members of the animal, and not less to the vegetable, kingdom. It may be truly said that man himself has produced no such important constructive effects on other organic beings, although his destructive effects have been probably greater. In the first place, the habits of many of the order in seeking their food in flowers have probably been the active agency in determining the forms of many of the latter, as well as of developing the nectariferous glands and increasing their secretion. This view was suggested by Müller and myself at about the same time, and has been elaborated by Henslow in one of the volumes of the International Scientific Series. In the next place, a number of animal types have been called into existence through the food and protection offered by the domestic economy of the ants. Among Vertebrata we have three families which live in ants' nests, all of which have become blind or nearly so, and two have lost their limbs, through the adoption of their parasitism on ants. Such are the Cæciliidæ (Batrachia), Amphisbænidæ (Lacertilia), and Typhlopidæ (Ophidia). Then many birds (Formicariidæ) live on ants and Termites, and two families of Mammalia, the Myrmecophagidæ in South America, and the Orycteropodididæ in Africa. Thirdly, the ants have domesticated numerous species of insects which they use for their secretions and for other purposes. In Europe about one hundred such species are known. The slave-making habits of various ant species are well known. This habit has been so long existent in certain species that the latter cannot exist without the aid of

their slaves. The latter care for their young, and even procure food for the adults. This habit is an illustration of a misdirection of intelligence. Originating in an intelligent appreciation of what the slave ants could do for them, they have become so dependent on the latter as to have lost some of the most important functions of self-preservation, so that their persistence in future time is necessarily more precarious than that of any other type of ants, *cæteris paribus*.

The fact that the practice of stirpiculture and social division of labor, with the laying up of food supplies, has developed independently in three different phyla is of much interest. These habits are exhibited by the Formicidæ and Apidæ of the order Hymenoptera, and by the Termitidæ of the Neuroptera.

The habits of the beaver display intelligence in two directions. They adopt an effective measure of security in building their dams so as to flood the entrances to their houses, thus protecting themselves from many foes. Secondly, they display mechanical skill in the construction of the dams, and in the location of their houses.

Some of the monkeys are the most intelligent of the animals below man. I had in confinement for several years three species of the South American family of the Cebidæ, which stands lower in the scale than the monkeys of the Old World. One of these was an Ateles, and it was rather stupid. The others were the *Cebus capucinus* and the *C. apella*. The former was the more intelligent. I have already referred to the tendency of these species to syncope under extreme fear. The *C. capucinus* possessed unlimited curiosity. Everything that came into its possession was closely scrutinized, and would be broken up, if possible, and the interior examined. It used sticks and stones for its purposes, much as is done by man. With the former it reached for objects not otherwise attainable, and in their absence would unfasten the leather strap that passed round its waist, and whip in desirable objects by throwing the free end round them. Sticks were used in defence, and were either thrown or held in the hand by one end. Pounding the shining sconce of a bald-headed friend was an amusement for which it was always ready. It threw stones

with considerable precision, overhand. Stones were also used for cracking nuts and other objects, and when the latter were resistant, it would leap in the air and bring the stone down with great force, and with many grotesque attitudes and grimaces.

It would draw bolts, lift hooks, and pull out nails which closed the door of its cage. I never knew it to open a buckle correctly, but it would pull out the threads which fastened the fold of leather which held the buckle, and so free itself from the strap. On one occasion it imitated the use of the drawing-knife by carpenters who were at work in the room in which its cage was kept. It secured a square rod of wood, and some fragments of sheet tin which had been left near its cage. It carried the wood to a shelf in the cage and sat on it, letting it project forward from between its legs. It took a piece of tin in both hands, and placing the edge across the wood, drew it rapidly backward and forward on the latter, just as the carpenters use the drawing-knife. This action it repeated frequently, with many grimaces and expressions of delight.

It was very expert in the management of its chain. It carried it in a coil of its tail over obstructions and objects on which it was likely to be caught, quite as carefully and successfully as could have been done by a human being. In this it showed its intelligence to be superior to that of dogs, cattle, or horses, who will wind themselves up when tied, and cannot unwind or extricate themselves.

In all these exhibitions the Cebus displayed predication, or conception of the consequences of certain causes; *e.g.*, the effect of being wound up, and the effect of carrying the chain in relation to its environment.

The Cebus was evidently conscious of wrongdoing. When detected in some particularly mischievous proceeding his furtive and downcast looks showed that he understood the nature of the act, and that before any word was spoken. He perfectly understood the tones of voice of his master, showing alarm or satisfaction as the case might be. In attacking a strange animal, as a dog, cat, or chicken, he always waited for the word of command; on receiving it he would spring towards the enemy with loud

ejaculations of hostility and open mouth, looking frequently to his master for approval.

When inclined to be sociable he made rapid movements of the jaws and lips as though endeavoring to talk, an appearance which was increased by the attitudes of the head and the inquiring expression of the eyes. The same habit is to be observed in the Old World monkeys, as in Cercopitheci and baboons. It appears to be one of the preliminary endeavors which in the ancestors of man led to the function of speech.

Deliberation and Judgment.—The condition of deliberation is a restraint of intended action in view of alternatives and uncertainties. This attitude of mind requires attention. As such action involves an intention, more or less distinct, it presupposes also an inductive basis of knowledge, and a deductive application of the same in practice.

Attention is commonly observed in animals, even of the lower types. A slight stimulus, as a sound, will arouse it, and it will be often continued long after this stimulus has ceased. This is commonly observed in Mammalia and in birds. It is well exhibited by tortoises and by snakes. The snake-like lizard, *Opheosaurus ventralis*, is easily tamed, and displays careful attention to the movements of its master.

Deliberation is seen in the careful selection of a suitable place for the deposit of eggs by a great many animals. Urged on by the emotion of egg-laying the animal restrains its desire until a place is found when the precious property can be safely concealed from the eyes of enemies. This kind of deliberation is seen as far down as the fishes, and the insects probably exhibit it as well. It is also seen in the careful examination of articles which may or may not be edible. Monkeys are untiring investigators, and they often scrutinize and critically taste objects with an evident view of ascertaining their character as edible or not. Carnivora pursue the same object by the use of the sense of smell. Fowls and other birds often deliberate over a doubtful object.

A dog will deliberate as to whether another dog or another animal is hostile or dangerous or not. An amusing illustration of this faculty is seen in the close consideration which a dog will

give to an insect which more or less resembles a bee or wasp. I have seen a bull-dog examine with care a large fly which resembles a bee, and evince much doubt as to whether it might be safely snapped up or not. When urged to attack the dog would do so with lips retracted and dripping with saliva, so that the teeth only might come into contact with the suspicious insect. This amusing illustration is well represented by a Belgian painter in a picture exhibited at the Paris Exposition of 1878.

In forming a decision on deliberation an animal performs an act of judgment. Like a concept, a judgment may be very simple or it may be complex. Its grades depend exactly on the grade of the percepts or concepts which are compared. But whether simple or complex, the formation of judgment is a metaphysical act. It results from a comparison of memories of percepts, or of generalizations derived from concepts of all degrees of generality.

Self-Consciousness.—This is a grade of consciousness which is probably found only in the human species, and is probably wanting to the lowest of human races. It is the introspection which occupies itself with one's own mental states. It more frequently occupies itself with past than with present mental states, for man is not accustomed to reflect on the character of his own mental acts when in action. He is conscious of them, as he is conscious of the movements of his own body, and he may also be as unconscious of the one as he is of the other. Moreover, self-consciousness may extend to the simplest mental acts as well as to the most complex. Hence I cannot agree with Mr. Romanes, who makes self-consciousness the condition of the formation of a concept. Nor can I think he has used the word subject in the usual sense when he restricts it to the self-conscious mind. The subject is that which is conscious in any degree, as distinguished from object, which is that of which the subject is conscious. So the insect, feeling pain, is quite as much a subject as a self-conscious man. Self-consciousness is a form of consciousness possible only to the highest grade of intelligence. In its exercise the subject becomes an object, when it is well termed the "subject-object." We have no certainty that any animals pos-

sess this capacity, but it is quite possible that some low types of men rarely or never practice it. This we may derive from their vocabularies, from which words expressive of introspective mental states are absent.

Consciousness of one's body and of one's mental sensations is no doubt present in animals. This is, however, simple consciousness, and not self-consciousness. Animals also possess consciousness of the mental states of other animals and of men. This is an inference based on their appearance, gestures, tones, etc., and one more evidence that many animals possess the rational faculty of induction or inference.

4. THE METHOD OF MENTAL EVOLUTION.

That the highest type of mind, as seen in mankind, has been produced by a process of evolution by descent from primitive beginnings would seem to follow from the history of the organism which displays it, *i.e.*, the nervous system and its ganglia. Whether there is any insurmountable obstacle in the way of such a belief will be considered in the present section.

We have traced the existence of various component elements of mind among the lower animals, and have found that the only quality which is not common to them and to man is that of self-consciousness. And of this there is doubt as to its existence in the lowest human races. We have, however, recognized that the animal mind cannot reach so high a grade of conception in the classification of the mental contents, as can man. But we have seen how very greatly human minds differ in this respect, so that there may be said to be a rising scale of mental organism from the lowest animal to the highest man, with but a slight interruption at the point where we pass from the highest ape to the lowest man. This slight interruption is due to the advent of language, which gave the mind a new machine, by which its power of accumulating experience was increased, and a firm hold over its conceptual faculty acquired. The very inferior quality of the minds of the lowest races, however, leads us to infer the former existence of still less intelligent men, and their extremely simple languages lead us to suspect that the time was when man devel-

oped language from inarticulate sounds and gestures, precisely as he has since developed new complexities expressive of the progressive advance of his mental power.

Mr. Romanes, in his work on the "Origin of Human Faculty," has been at great pains to examine and elucidate the question of the origin of the human intelligence, and I cannot do better than refer my readers to it as the best exposition of the subject in existence.

The experiential theory adopted by Locke as a statement of the history of the human mind has been shown by Herbert Spencer to be more correctly an explanation of the development of the mind of animals in general, including that of man. On this hypothesis, while it is admitted that much may be acquired by each individual human mind by experience, it is asserted that more has been acquired by the race in general, and handed down to the existing generations by inheritance. It is further held that the elements of the mind of man were not acquired by him at all, but have been derived by him by inheritance from the preëxistent members of the animal kingdom from whom he is descended. It is the qualities which are thus inherited which appear to the student who is unacquainted with this explanation of their origin to be spontaneous, or "intuitive" to the human mind. Thus the so-called intuitions of man are shown to be the organized products of the experience of preceding generations. The question of the origin by experience of the powers of thought of man is quite independent of the metaphysical question as to whether a given truth is contingent or necessary. The former may depend more directly on experience than the latter, but the capacity to apprehend the latter is as necessary a result of evolution as is the capacity to apprehend the former, if the evolution of the human mind be admitted. Of the truth of this mode of explanation of the origin and growth of the latter there seems to the present writer to be no doubt.

As sensation appears to be present in some or all of the Protozoa, without corresponding organs of sense, general or special, we believe that their protoplasm or part of it is endowed with a diffused conscious sensibility. Organs of a special sense, sup-

posed to be sight, are present in many Infusoria in the form of small aggregates of red or black pigment. From such a source organs of developed sight can be traced, the subsequent additions of retinal nerve supply, humors, etc., having been observed in animals of successively higher types. Thus we have ground for believing in the evolution of this form of special sense step by step.

General sensation is immediately localized on the appearance of special organs for its activity. These are the threads and bodies, termed nerves and ganglia, which appear first in the ascending scale in the Cœlenterata. From the simple structures presented by the jelly-fishes we trace the successive evolution of the nervous system up to its highest expression in the Mammalia and in man. Thus we have the physical basis of the evolution of sense-perception plainly before us. The belief in the evolution of the more complex forms of perception from simple consciousness is therefore inevitable.

The evolution of ideation may be traced along the lines of the affections and of the intelligence. The affections differ among themselves in degree of intensity as well as in kind. In their simplest form they are mere preferences, or likes and dislikes; in a more pronounced type they are the affections; while in their forms of greatest intensity they are the passions. The evolution of the emotions is therefore quite comprehensible under the direction of use and experience. Profitable use develops strength, while experience of the evils of unprofitable use develops restraint and disuse. The desires and affections furnish the stimuli to action, whence comes experience, and therefore ratiocination. Reason, in turn, furnishes material to the affections, and also guides them to the accomplishment of their desires.

It is evident that without consciousness the development of ideation would be impossible. Ideation is a result of education or the experience of pleasures and pains. The appetites are conscious states, and they furnish, with general and special sensation, the basis of the knowledge which animals possess of the material world. Granted consciousness, and the progressive development of ideation is necessary, except in certain cases where degeneracy

is exhibited. The changes of the seasons, the periodicity of the appearance of vegetable food, the irregular production of animal food, the struggle for existence between animals themselves, all furnish the materials of memory, and the stimuli to emotion, attention, conception, induction, and all forms of mental activity. By means of memory these results are cumulative; and by reason of the effects of these activities on structure of the nervous centres the faculties themselves are augmented in power, and may become finally automatic, or be performed without the presence of consciousness. Such automatic acts or habits may become so fixed as to be surrendered with difficulty, or not at all, after changed circumstances render them no longer beneficial. They are termed instincts, and for a long time an essential difference was believed to exist between Instinct and Reason. But it is now evident that man possesses the primitive instincts in common with the lower animals, and various tribes of men display especial characteristics which have become congenital, and may be properly termed instincts. Such are the habits of a nomadic people, which they give up with great difficulty. Such is the instinct for the chase which persists in some men so that they move ever further off the frontier of a more sedentary civilization. Since it is known that many of the lower animals can reason, the supposed distinction between Instinct and Reason disappears entirely.

As in structural evolution, ontogeny furnishes us with a guide to phylogeny. The study of the growth of the infant mind throws much light on its general evolution. The primitive condition of the emotions is that of appetites. The first of these in the necessary physiological order, and hence in time, is the appetite of hunger. Second in order in the history of life, but not in the growth of individuals, is the instinct of reproduction, such as it is in animals who only multiply by fission. Very early in evolution the emotion of fear must have arisen, and it is probably the immediate successor of hunger in the young of most animals. Anger appears as early as the mind can appreciate resistance to its first desires, and no doubt followed as third or fourth in the history of evolution. The rudiments of parental feeling would follow the origin of reproduction at a considerable interval of

time. One of the latest of the instincts to appear would be the love of power; while later still would be the emotions of relativity (Bain), because they are dependent on a degree of mental appreciation of objects. Such are admiration, surprise, and wonder. These, as well as all other consequences of inherited intellect, appear earlier in infancy than they did in evolution, by the process of "acceleration," as may be readily understood.

Of these instincts and emotions it is to be supposed that hunger remains much as it has ever been. The reproductive instinct has, on the other hand, undergone the greatest modifications. Sex instinct could not have existed prior to the origin of the differentiation of sex. Hence it is probable that the parental instinct preceded the sexual in time. These two instincts, being the only ones which involve interest in individuals other than self, furnish the sources of sympathy in all its benevolent aspects. Hence it has developed in man into the powerful passion of love; into affection and charity in all their degrees and bearings. Fear being, as Bain shows, largely dependent on weakness, has varied in development in all times, but must be most pronounced in animals of high sensibility, other things being equal. Hence its power has, on the whole, increased until it probably reached its extreme in the monkeys or the lowest races of men. Increasing intelligence of the higher order diminishes the number of its occasions, so that it is the privilege of the highest type of men to possess but little of it. The earliest of the emotions of relativity to appear in time has probably been the love of beauty; how early it may have appeared it is difficult to imagine. Surprise and wonder, as distinct from fear, one can only conceive as following an advanced state of intelligence.

Thus in psychology the paleontological order of development is somewhat different from the embryological. I have compared the two orders as follows: *

PALEONTOLOGICAL.	EMBRYOLOGICAL.
Hunger.	Hunger.
Reproduction.	Fear.
Fear.	Anger.

* AMERICAN NATURALIST, September, 1883.

Anger.	Beauty.
Parental instinct.	Wonder.
Sex.	Power.
Power.	Pity.
Beauty.	Sex.
Wonder.	Parental instinct.

The qualities enumerated in the first column follow each other directly in order from the simple to the complex. In the second column this order is disturbed by the earlier appearance of the derivative emotions, beauty, wonder, and pity or benevolence, and the later appearance of the simple emotion of sex. Thus in psychological as in other evolution some of the products of development appear earlier and earlier in life in accordance with the law of *acceleration*.

It is evident that a capacity for ideation has been developed, which is capable of conception or generalization. This is seen in the capacity which animals frequently display of adapting themselves to new situations. This is accomplished by the conception of the general resemblance of the new case to certain old ones, although there may be much difference in detail. Thus Mr. Belt tells of an army of ants on the march which crossed a railroad track on which cars were frequently passing. The wheels crushed the ants as they crossed the rails. This was observed by the ants, who at last escaped the danger by burrowing under the rails. Mr. Beaumont relates that some Termites which he had imprisoned in a glass jar with perpendicular sides escaped from it by an ingenious use of a secretion of their bodies which they ordinarily used in building their nests and covered roadways. The soldiers furnished the workers with a semifluid cementfrom their bodies, which the latter deposited on the glass, where it hardened. They thus made a roadway to the top of vessel, over which the insects passed out. The faculty has plainly developed from the simple to the more complex. The difference between the dart-throwing of the Infusorian Dinidium and the dam-building of the beaver is one of degree only, and not of kind. The difference of degree resides in the more numerous means necessary to the beaver's act than to that of the Dinidium.

The latter throws only its own indurated cilia; the beaver uses the earth for burrowing, the water for covering, and the timber for building both the dam and its house. The more complex the performance the more likely is the animal to employ also the deductive act. Thus in the case of the building of nests by birds and trap-door spiders, when customary materials are wanting, new ones are adopted; that is, a known rule as applied to new cases.

The manner of the evolution of the concept has been as follows: The sensible qualities of objects are first learned, and stored in the memory. The qualities must be distinctly localized in the nervous centers, otherwise confusion of memory would result. Thus if a red bird is perceived to sing on a tree four distinct perceptions are experienced. First, a bird's form; second, a red color; third, the song of a bird; fourth, a particular tree on which the bird was perched. It is not probable that that part of the nervous center which perceives form is identical with that which perceives color, nor either with that which perceives sound. The constituent parts of the center have become specialized into different regions, each capable of apprehending a different quality. Each locality is blind or deaf, as the case may be, to that stimulus which affects the other, although all may be alike reached by the vibrations, or whatever the form of stimulus may be, which is derived from the common source. And each is so joined by connecting nervous threads with all of the other localities, that the general idea of the entire object is not lost. Thus we may believe that there is a localization of the sense of form, where forms are recorded, and may be compared and their identity or difference be consciously known. In simple minds identity would be often perceived, and slight differences be disregarded. Hence the simple conceptions of the animal mind. In more advanced minds, with greater specialization and organization of structure, minuter differences, as well as wider resemblances would be recorded, and would enter into consciousness. The combination of percepts form the lowest grade of concepts. Still higher development would render possible wider combinations through the development of nervous connections between more

widely separated localities of record, and their conduction to added portions of the center or locality of gray tissue, where consciousness would necessarily perceive the resemblances and differences thus set before it.

Finally, the lower concepts thus gathered from perceptions could be transmitted to a functionally still higher center, where their resemblances and differences should become obvious to consciousness, and the highest concepts, inductions, or judgments result.

In the tracing of the development of this mechanism and its function, I once more call attention to the fact that without the presence of consciousness the whole process is useless as a mental evolution. I must consider later the question as to how or why the specialization or location of sense-perception should take place. That it actually exists has been demonstrated by the researches into brain and cordal physiology conducted in recent years.

Leaving for a moment the question of the physical basis, I revert to the metaphysical side of evolution of mind. It is generally admitted by evolutionists in the field of psychology that experience is the immediate agent of such evolution; or, in other words, that it is a process of education, the possibility of such education being dependent on consciousness and memory. There is here no ambiguity as to the method. Consciousness is educated by the direct action of the environment as determined by the active or passive condition of the organism. In other words, the environment impresses itself directly on the consciousness of the organism, and a memory remains, which is the guide to the future movements of the latter, and this process has been in operation ever since life has existed, and the result has been the human mind.

We have here no promiscuous or fortuitous activity of sensation, nor is any possible, since sensations are only produced by a stimulus from a definite material source. There is no "survival of the fittest" at this stage of the process, but a calling into being of new sensations, and consequently of new movements. Here we have the origin of mental changes distinctly before us, and the question of their survival comes up at

a later stage of evolution. Responses to stimuli are, however, necessarily "fit" or appropriate to the stimulus, and it can only be other features in the environment which can make them otherwise. And this unfitness cannot continue,—not because its possessor is necessarily destroyed, but because new environments produce new sensations and new educations. It is therefore in the evolution of mind that the doctrine of natural selection breaks down completely, even as a directive agent. As an originative method it has no application.

We have now reached the keystone of the arch of evolution, so to speak, and we can retrace our steps over the ground of the origin of structure, with which we commenced. The next question which we have to discuss is that of the effect of mental conditions on the movements of organisms.

THREE CASES OF HYPOSPADIAS IN WHICH THE SEX WAS UNDETERMINABLE UNTIL PUBERTY.

BY DRS. L. H. AND W. H. LUCE.

THESE cases are chiefly interesting from the fact that they all occurred in one family; and on account of the slow evolution of the organs continuing after birth up to puberty.

The cases, the subject of this article, consisted of three of six children. The parents were of normal development physically, but of strong nervous temperaments, there being cases of insanity on both sides,—the father on the paternal side, and nieces on the maternal side. The father was a sea captain (whaling), intelligent, of indomitable courage and great energy. The mother was also intelligent, and above the average in courage and energy, belonging to a large family of sturdy sea captains celebrated for their hardihood. The two did not live happily together; the wife, it was said, was frequently the subject of maltreatment at the hands of her husband *during her pregnancies*. There were no cases of deformity or deaf mutes in any of the ancestry on either side,

though there are two deaf mutes in the family of a brother on the husband's side. Of the five children born in this family, three were boys and two were girls. The sex of two of the boys and one of the girls was undetermined at birth, and was not fully determined until puberty, the boys during the intermediate period *receiving girls' names and wearing female apparel.* They attended school dressed in female attire, and sat on the girls' side. About the age of puberty they were suddenly sent away to school, still dressed in female attire and bearing female names. In due time they returned, *dressed in male attire and bearing male names.*

In after years they were married, and a suit brought by the wife of one, charging "that her husband was not a male," enabled me to make a careful examination of the genital organs in order to establish the fact whether he was or was not a male. I may say, *en passant,* that the suit was granted by the court on the ground that although a male he was not capable of procreation.

The examination disclosed the following: *General appearance:* That of an unusually well-developed and handsome man, five feet eleven inches in height, weighing 180 pounds. Of a nervous-sanguine temperament. Face at this time hairless. Breasts normally developed.

Genital organs: A deep sulcus extending from the pubes to the perineum; in fact, occupying the place of the external organs of generation of the female. *Posteriorly* it terminated in a cul de sac, sufficiently deep to admit two fingers to the depth of two inches. *Anteriorly* was an abnormally-developed clitoris, two and one-half inches in length, having a glans and prepuce, but *imperforate.* The orifice of the urethra was found at the base of the clitoris, there being an entire absence of the triangular smooth surface known as the *vestibule.* The urethra opened into a normally-developed bladder. The integument, situated in front of the pubes, and which in the female is known as the mons veneris, was more developed than is usual in the male, and was covered with an abundant crop of hair. The folds of integument on either side of the sulcus (labia majora) contained a normally-developed testicle, having the usual form,

size, and general conditions of the male testicle. Placed within the folds of integument containing the testicle and enclosing the upper third of the sulcus were two smaller folds, the homologues of the labia minora in the female.

This description also answers for the brother. Of the girl not so much is known. What is known is as follows: At birth a very large clitoris was observed, so large that at first she was supposed to be a boy. Although dressed in female attire, she was retained at home, and it was not until about puberty that her sex was positively ascertained. Those who associated intimately with her frequently remarked that she ought to be in male attire. The subjects of this sketch are of good average ability, the boys being engaged in business, and the girl attending to her family duties satisfactorily.

All are married, but without issue.

The doubt as to the sex in these cases, extending through infancy and childhood up to adult age, with slow development of the genitalia, makes it of interest to the biologist.

L. H. Luce, M.D.

The family in which these cases occurred consisted of six children. Three of them were indisputably females, as was subsequently verified by two of them bearing children, though the youngest was reported to be malformed, probably from the fact of her possessing an immense clitoris, and was masculine in appearance. The eldest girl married, but soon separated from her husband. I did not become professionally connected with the family until after the first children were born, and was present at the births of the two youngest only,—one a perfect male in every respect, the other also perfect, with the exception of the genitals, which were malformed. At first sight they were female organs, and the appearance was so perfect and deceptive that I did not give it a second thought until the nurse called my attention to it. Examination revealed the following make-up of the parts: Two apparently perfect labia were divided by a deep sulcus, covered by the common skin, which grew deeper as it ran under the pubic arch, and took on more of the characteristics of

mucous membrane, and ended in a cul de sac. At the root of a small penis, imperforate, the orifice of the urethra protruded. As I could not detect any testicles, and thought it might possibly be an imperforate vagina, I advised them to await developments before deciding the sex; but from the experience of the previous case it was concluded to consider it a male. Subsequently, after puberty, I made two examinations, and found two well-developed testicles situated in the lower part of the false labia. His sexuality was strong. He eventually married, but his wife obtained a divorce. The eldest, of whom I had no knowledge except by common report, was thought by his parents to be a female up to the time of puberty, and was given a feminine name, but was then changed to a masculine one, and male attire adopted. This case was presumably identical with the other. The parents were robust, healthy people, with no peculiar hereditary tendencies. The father was a powerful man, possessed of an uncommonly strong will, strength, and energy, but of violent and ungovernable passions. The mother was the opposite,—mild and amiable, and markedly feminine in appearance. She was often the victim of his ungovernable temper. A brother of his had eleven children, all females. The mother and the six children are yet living; the father is dead.

WM. H. LUCE, M.D.

MORPHOLOGY OF THE BLOOD CORPUSCLES.

BY CHARLES-SEDGWICK MINOT.

IF one goes through the very extensive literature dealing with blood corpuscles one finds the most divergent views defended, and can hardly reach clear ideas, for the conceptions do not agree among themselves, either as to their structure or as to the development of the corpuscles. According to some the red corpuscles arise from the white; according to others the white corpuscles arise from the red; and according to still others both kinds arise from indifferent cells. In regard to one point only is the majority of investigators united,—namely, in the silent assumption that all blood corpuscles are of one and the same kind in spite of the absence of the nucleus in mammalian corpuscles. It is just this assumption that has caused endless confusion, and the morphology of the blood corpuscles can be cleared up only by starting with the recognition of the fundamental difference between nucleated and non-nucleated corpuscles. Farther, it must be recognized that no corpuscles, neither red nor white, arise from nuclei.

The origin of red corpuscles from nuclei has been maintained several times. This notion is based upon defective observations. It is very easy in the chick, for example, to convince oneself that the first blood corpuscles are cells; in the area vasculosa, at the time of the blood formation, the red blood-cells are readily seen, in part lying singly, in part in groups (blood islands), adherent to the vascular walls; the free cells are constituted chiefly by the nucleus, which is *surrounded by a very thin layer of protoplasm,* which is very easily overlooked, especially if the preparation is not suitably stained; this explains, I think, the statement made by Balfour (Works, Vol. I.) and others, that the blood corpuscles consist only of nuclei. By following the development along further we find that the protoplasm enlarges for several days, and that during the same time there is a progressive diminution in size of the nucleus, which, however, is completed before the layer

of protoplasm reaches its ultimate size. The nucleus is at first granular, and its nucleolus, or nucleoli, stands out clearly; as the nucleolus shrinks it becomes round, and is colored darkly and almost uniformly by the usual nuclear stains. This species of blood corpuscle occurs in all vertebrates, and represents the *genuine blood-cells*. According to the above description we can distinguish three principal stages: 1, young cells with very little protoplasm; 2, old cells with much protoplasm and granular nucleus; 3, modified cells with shrunken nucleus, which colors darkly and more uniformly. I do not know whether the first form occurs in any living adult vertebrate, although the assumption seems justified that they are the primitive form. On the other hand, the second stage is obviously that characteristic of the Ichthyopsida in general, while the third form is typical for the Sauropsida. Therefore the development of the blood-cells in amniota offers a new confirmation of Louis Agassiz's law (Haeckel's Biogenetiches Grundgesetz).

The blood-cells of mammals pass through the same metamorphoses as those of birds; for example, in rabbit embryos the cells have reached the Ichthyopsidan stage on the eighth day; two days later the nucleus is already smaller, and by the thirteenth day has shrunk to its final dimensions.

The white blood corpuscles appear much later than the red cells, and their exact origin has still to be investigated, for it has not yet been determined where they first arise in the embryo; nevertheless we may venture to assert that they arise outside the vessels. The formations of leucocytes outside of the vessels is already known with certainty to occur in later stages, as well as in the adult. The sharp distinction between the sites of formation of the red and white cells appears with especial clearness in the medulla of bone in birds, as we know from the admirable investigations of J. Denys (La Cellule, Tome IV.). The white blood corpuscles, then, are cells, which are formed relatively late, and wander into the biood from outside.

The non-nucleated blood corpuscles of adult mammals are entirely new elements which are peculiar to the class, and arise neither from red nor yet from white blood-cells. Their actual

development was first discovered, so far as I know, by E. A. Schäfer, who has given a detailed account of the process in the ninth edition of Quain's Anatomy, and has shown there a full appreciation of the significance of his discovery. Unfortunately Schäfer's important investigations have received little attention. Kuborn has recently confirmed Schäfer's results in an article (*Anatom. Anzeiger*, 1890) on the formation of blood corpuscles in the liver. One can readily study the process in the mesentery and omentum of human and other embryos. The essential point of Schäfer's discovery is that the non-nucleate corpuscles have an *intra*-cellular origin, and arise by differentiation of the protoplasm of vasoformative cells. Several corpuscles arise in each cell without participation of the nucleus; they are, therefore, specialized masses of protoplasm, and may perhaps best be compared to the plastids of botanists. I venture to propose the name of blood-plastids for these structures, since the term corpuscle (globule, Körperchen) has no definite morphological meaning.

Sonsino (*Arch. Ital. Biol.* XI.) affirms that the red blood-cells transform themselves into plastids. I have, however, never been able to find the intermediate forms in my own numerous preparations. I deem it probable that he has seen merely the degenerating stages of the red cells.

The present article is an abstract of a communication made in August last to the American Association for the Advancement of Science. Since then Howells' memoir on the blood corpuscles has appeared (*Journal of Morphology*, IV., 57). The author describes the ejection of the nucleus from the red cells, and believes that this results in the formation of red plastids. The process is, I think, really degenerative, and the resemblance between the non-nucleated body of the cell and a true plastid is not one of identity. Certainly, until proof is offered that the observations of Schäfer, Kuborn, and myself upon the intra-cellular origin of the plastids are proved erroroeus, the emigration of the nucleus of the red-cells cannot be held to result in producing plastids, but only to be degenerative. That the red cells degenerate and disappear has been known; Howells' valuable observations indicate the method of their destruction.

The above review shows that the vertebrate blood corpuscles are of three kinds: 1, red cells; 2, white cells; 3, plastids. The red and white cells occur in all (?) vertebrates; the plastids are confined to the mammals. The red cells present three chief modifications; whether the primitive form occurs in any living adult vertebrate I do not know; the second form is persistent in the Ichthyopsida, the third form in the Sauropsida. According to this we must distinguish:

A.—ONE-CELLED BLOOD, *i. e.*, first stage in all vertebrates; the blood contains only red cells with little protoplasm.

B.—TWO-CELLED BLOOD, having red and white cells; the red cells have *either* a large, coarsely granular nucleus (Ichthyopsida), or a smaller, darkly staining nucleus (Sauropsida, mammalian embryos).

C.—PLASTID BLOOD, without red cells, but with white cells and red plastids; occurs only in adult mammals.

Mammalian blood in its development passes through these stages, as well as through the two phases of stage B, all in their natural sequence; the ontogenetic order follows the phylogenetic.

I pass by the numerous authors whose views conflict with mine, partly because the present is not a suitable occasion for a detailed discussion, partly because those authors who have asserted the origin of one kind of blood corpuscle by metamorphosis from another have failed to find just the intermediate forms; it seems to me, therefore, that most at least of the opposing views collapse of themselves.

PROBABLE CAUSES OF POLYGAMY AMONG BIRDS.

BY SAMUEL N. RHOADS.

DURING a recent perusal of Darwin's "Descent of Man," I was impressed by the frequency of his citation of gallinaceous birds as best illustrating the theory of sexual selection in its relation to the development of secondary sexual characters among animals. Probably half the species cited in the four important chapters devoted to birds belong to the Gallinæ, and this may be taken as sufficient proof that the order deserves special study in our search for the causes of sexual variation, the history of descent, and the origin of special characters, which, we have reason to suppose, are the result of progressive development from ancestral beginnings.

Gallinaceous birds, as an order, are noteworthy,—nay, almost unique,—for their love antics, use of instrumental music to supply deficiency of vocal organs, manner of ornamentation in color and form, seasonal moult for special protection, combativeness, and the practice of polygamy.

It not being Darwin's object to treat of polygamy, save in its connection with development of secondary sexual characters, we find no attempt on his part to explain the causes of it; nor, so far as I am able to discover, has such attempt been made public by any one. Darwin, however, calls our attention to the fact that among all avian forms which practice polygamy there are none which do not present strongly-marked sexual differences.[1] This is significant, and leads to the supposition that the two characters, being inseparable, are also interdependent. I shall endeavor to prove that polygamy, from the nature of those causes which produced it, is necessarily associated with strongly-marked sexual differences, though these differences sometimes exist among monogamous species; in other language; that distinctive sexual characters are a necessary factor to the existence of polygamy in birds. A few exceptions to this rule, notably of the

[1] Descent of Man, Vol. I., pp. 257–262.

horse, which exhibits slight sexual disparity, are to be found among polygamous mammals, but so far as we know, none exist among aves. Seeing that such is the case, it is fair to infer that monogamous birds should present, if any, much less distinctive sexual differences. Generally speaking this is the rule, and it will be shown that the exceptions to it result from peculiar conditions of environment or of physical structure which nullified the tendency to polygamy.

The value of the following remarks must depend somewhat on the success with which Darwin has proved that sexual selection is the cause of specific distinctions among birds through successive variations, induced by the choice of the female during courtship. The conclusions arrived at in this paper are therefore supplementary to his, and are based on the supposition that although he may have attached too great importance to his theory of sexual, as distinguished from natural, selection, we must believe, nevertheless, that sexual selection exerts a powerful influence in the genesis of species.

Premising this, we may conclude: 1st, That the present status of development in birds practicing polygamy is the result of sexual selection. 2d, That the standard of female choice was, in the majority of cases, the relative perfection of beauty of coloration in the male and hence also of display by him, from which habit would arise the tendency to specialization of form, as instanced in the extraordinary development of alar and caudal appendages among many polygamous species. 3d, That in proportion to this tendency toward plumage specialization the male differs from the female in that he alone develops thus; therefore, 4th, In view of this, we must conclude that all polygamous species have originated from a less ornamented type which more closely resembled the female than her mate of to-day, while the difference between these was reduced to a minimum in the distant past; and that the young of both sexes remained constant to the garb of the adult female during the first year. 5th, That this specialization was not transmitted to the female and young, owing to their greater need of protection by obscure tints, and to the incon-

venience of those ornamental appendages during the period of reproduction.[1]

Added to these necessary results of sexual selection we should note the fact that, in proportion to the higher coloration or other masculine superiority of ornament over that of the female of the same species, all birds are more pugnacious and destructive to their rivals, and this tendency among those of polygamous habits finds further vent in their destruction of the eggs and newly-hatched young.

From what has been said we may reasonably assume that strongly-marked, sexually limited, secondary characters, and a combative, irritable disposition, being ever associated with the habit of polygamy, they therefore must be in some way interdependent, and the one naturally resultant from the other. Nor do the results of inquiry in this direction refute such assumption, however they may seem to fail to establish its verity or give a satisfactory solution of the problematic causes of polygamy as practiced by birds. Shall we consider, then, that the polygamous habit is a cause of the tendency to perfection of secondary sexual characters, or that it is a result of that tendency? I incline to the latter opinion.

As we descend in the scale of being the lower orders become more strictly monogamous, till finally, among the lowest, androgynous forms appear, multiplying *ad infinitum* among the least specialized; whereas, if we ascend from these it is noticeable how the disposition to polygamous unions is confined to the highest type of a genus or the higher genera of the sub-order.

The genesis of to-day is an epitome of the genesis of those myriad yesterdays we call the past. If this be true we have no alternative but in the belief that birds originally practiced monogamy only, that ancestral forms presented no sexual disparity in size, coloration, or ornamentation, and that, in the case of the Gallinæ, its representatives may have originated from an obscurely-tinted, plain-haunting, monogamous ancestor.

Given, then, such a starting point, we advance on the supposition that sexual selection by the female, according to the stand-

[1] For full discussion on these points see "Descent of Man," Chaps. XV. and XVI.

ard of beauty of form and color of the male (a criterion of first importance in female choice) inclines to variability in the secondary characters of her offspring. Take a hypothetical case: A monogamous female Gallus, actuated in times long past by sudden fancy (causation always obscure), gives preference to a male of her kind because of his individual superiority as a bird of extra fine feathers and bearing. Their young naturally inherit somewhat of the parental peculiarity, and in accord with a recognized law, styled that of "prepotency," among highly-colored birds, they are also strong, healthy, and have a sexual vigor above their compeers. Thus inaugurated, the selective faculty works its unconscious leaven during centuries of slow development until the male descendants of that first pair would become conscious of their superiority and of the value of their peculiar charms to the females. Courtship, as distinguished from mere off-hand pairing, would now assert itself as a necessary preliminary to more intimate relations, the result of which is seen at the present day in the love antics, war dances, and dress parades that characterize the amours of polygamous birds. Pride and vanity inevitably follow competitive display, however innocent its origin, and by a natural and easy progression comes the passionate appeal to arms, culminating in the periodic passage-at-arms in a chosen arena. No pyrotechnic result this, but effected by centuries of slow combustion from a spark of female fantasy!

"So far not impossible," say you; "but where is your polygamist?" I answer: "There he is, as far as description may identify or an introduction make him your acquaintance; henceforth he can be no other; thus born, thus bred, polygamy is an inevitable result." As surely as the Eastern despot, of kingly descent and inherited superiority in mental and physical prowess, taketh unto himself, by virtue thereof, a harem of wives, so will our modern Gallus aspire to polygamous concubinage when he finds himself on the "lek"[3] of a spring morning, with glad prospect of a tournament ere sunrise herald him the victor of many a tilt.

[3] The spot chosen by polygamous birds on which to display their charms and battle for the ownership of the females.

Resultant upon the first display of rivalry in a monogamous species, which by reason of sexual selection has developed strong sexual distinctions, would begin the destruction of many males, while the females would be exempted. Besides this the victorious males would drive away and disable many which would otherwise pair, and the females, as numerous as ever, would consort with the victor,—some by choice, the rest instinctively. He, having in the first instance undesignedly made himself lord, not of one but of many, would probably, in accordance with former habit, pair with one and disregard the rest, which latter, finding themselves widowed of a chance to mate elsewhere, would solicit his attentions, and in course of time receive them, because of their importunities rather than from his desire of self-gratification. Plural intercourse, thus persisted in, would be sure to become habitual, and the desire of gratification develop in like ratio.

In this connection the statistics collected by Darwin of the numeric proportion of the sexes in birds show that, especially among the Gallinaceæ, females are less numerous than males, the most polygamous of these showing the greatest discrepancy. The proportion of male to female chicks, in a careful census of 1000 bred during eight years, was as 94.7 to 100, an excess in favor of the females. But with respect to birds in a state of nature, Brehm, Gould, and others assert that the males are proportionately far more numerous, and an experiment with the eggs of wild pheasants resulted in the production of "four or five males to one female." The ruff (*Machetes pugnax*), sole polygamist among the Scolopacidæ [4] exhibits similar disproportion.

While it should be remembered that females, because of their shy, retiring disposition and different period of migration, are not so likely to be seen by an observer or captured by the fowler as the more conspicuous and daring males, it may not be doubted that the number of the former exceeds that of the latter in most instances. Nor can we deny that some connection is apparent between this numerical ratio of the sexes and the practice of polygamy.

[4] The Solitary Snipe (*Scolopax major*) is thought to be polygamous. See Lloyd's "Game Birds of Sweden," 1867, p. 221.

It has been observed that among animals a prepotent male is likely to generate more females than males, while in the offspring of an impotent male the reverse holds true. This, is it will be seen, tends to balance the sexual proportion among polygamists, for the overproduction of females by a generation of prepotent males would finally exhaust their sexual power by the demands of excessive intercourse; and, as a result of the impotency thus incurred, the number of young males would increase. Hence polygamous sexual intercourse, while tending to extinction of the species when carried too far, has within itself a remedy by the natural tendency to increase the percentage of males in the next generation. This compensatory law, whereby nature seeks, as it were, to cure the evil results of polygamous excesses by male overproduction, may explain the present state of affairs as cited by Darwin and quoted above. Evidently the reformatory process is going on at the present day among the species enumerated, because the males are yet overtasked by too great preponderance of females. We find strong proof of this in the very examples given, for in the case of the domestic fowl, whose connubial relations are wisely regulated by the careful breeder, a larger percentage of female chicks were produced, while the eggs of unrestricted wild pheasants brought forth four times as many males as females.

Furthermore, it is worthy of note that among highly-ornamented animals virility is excessive. Cock pheasants, restricted to a scant number of hens, are sure to abuse them on that account, and the canary (*Fringilla canaria*), a monogamist by nature is, by reason of domestication and consequent specialization transformed into a modified polygamist, and in case he be not provided with more than one mate, she is tormented by his excessive amours. Like the turkey cock, male canaries will frequently destroy both eggs and young, presumably to induce the female to renew the sexual relation. The case of the canary is very convincing proof that human interference in sexual selection, with a view to higher coloration or improvement in secondary characters, has actually created excessive sexual power and desire, by virtue of which the bird's monoga-

mous nature is so changed as to induce it to polygamy. We may infer, therefore, that sexual power and high sexual characters go hand in hand, and that in proportion to the advance toward organic perfection, virility increases. A canary, so domesticated, probably would not at first endeavor to mate with more than one female, if not induced to do so by the breeder; but in a cage where one male is associated with many females his flirtations are notorious, and like human polygamists he practices favoritism,—one is his mistress, the rest, according to his inconstancy, maids of dishonor. No less convincing is the case of the wild mallard (*Anas boschas*). If a male and several females be captured and restricted to the limits of a small pond, and receive proper care, the latter will all receive the voluntary attentions of the drake, though in a state of nature he contents himself with one.

Especially, if not exclusively, does this hold true with monogamists presenting strong sexual differences. On the contrary, we should observe that species of slight sexual dissimilarity (and therefore plainly colored), however subjected to long domestication, retain with tenacity their original monogamous habits. For example, the male guinea fowl (*Numida meleagris*), when forced to associate with more than a single female, chooses one and ignores the rest; and Dixon asserts, in his book of "Ornamental Poultry," that the eggs of one female alone will, in such a case, prove fertile. Domestication, therefore, in the abstract will avail nothing unless seconded by previous condition of high ornamentation and strong sexual differences, or unless directed to the production of these. In the breeding of guinea fowl high coloration was not an object; in the canary it was a most desirable production; in the mallard it already existed, and required but slight change of environment and food habits to induce its possessor to alter its marriage code.

Putting facts together, I am induced to believe: 1st, That sexual selection in favor of beauty of color and form of secondary characters, whether voluntary or the result of man's interference, is always accompanied by proportionate increase of sexual vigor. 2d, That such increase is a provision of nature to

meet the excessive demands of consequent polygamous practices. 3d, That such prepotency, being born, so to speak, of sexual selection, may be restrained by unfavorable climatic conditions or inherent specific peculiarities in its tendency to produce such practices, while among species that are free from these limitations polygamy finds willing victims. 4th, That domestication may conduce to polygamy in two ways,—first, by removing these limitations, as in the mallard; or second, by artificial development of special characters not found in a state of nature, as in the canary. 5th, That the domestication of a monogamous species of slight sexual differences, unless first directed to the higher development of secondary characters, will have no influence on the connubial relations, as instanced by the guinea fowl.

It may be asked, Why, then, are not many highly-colored species merging toward polygamy? I reply that probably many are. The Trochilidæ, according to Salvin, are in some cases polygamous, and so are the Paradiseidæ, if we may believe Lesson, though Wallace inclines to doubt the fact. More intimate acquaintance with these families during the breeding period will possibly reveal indubitable proof that they contain many examples of a habit which, as is shown, is developed only in connection with extraordinary sexual secondary characters.

As was mentioned in the third of the above conclusions, the tendency towards polygamous unions may be checked by many circumstances of a physical or mental nature, or it may be nullified by conditions of environment. Among many highly-plumaged groups we find less quarrelsome dispositions than is common with the majority. This may be caused by climatic or constitutional influences, which, however, did not prevent development of secondary characters by sexual selection, yet restrained in great degree the spirit of rivalry and consequent destruction of high-tempered males commonly attendant on such development. Again it appears that the quarrelsome disposition is powerless in other families to destroy much life, because of the ability of males to escape each other when defeated, which, coupled with the uniform distribution and individual independence of the sexes in species of arboreal habits, enables conqueror and con-

quered equally certain of a wife,—"a Jill for every Jack," so to speak.

Birds most noted for polygamy are least adapted for escape by flight, and because of their terrestrial habits are more intimately associated for self-preservation. They are more liable to the attack of enemies both terrestrial and aerial, less migratory or capable of migration, and hence suffer more from vicissitudes of weather. Their habit of family association, added to the pugnacity of the males and clannishness of the females, results fatally to the weaker males, while the majority of those that survive are ostracized (another form of death) because of their inability to find a mate outside the harem. It is apparent, therefore, that the Gallinæ, on account of their physique and ancestral predilections, were constitutionally more likely to develop polygamous habits as they rose in the scale of being than the higher insessorial groups. I am disposed to believe that careful scrutiny of the habits of the Trochilidæ and Paradiseidæ will reveal that the former does not contain any polygamous species, but that the latter as a family generally practice it.

I base such a prediction purely on analogical reasoning from what is presented in the preceding paragraph. The Trochilidæ are remarkably pugnacious, but for structural reasons are quite harmless combatants, however furious and spiteful their contests may appear.[5] Further, their powers of flight enable them to escape each other, to seek and find females over a vast expanse of country, and to escape destruction from enemies despite their high ornamentation. With the birds of paradise we are less acquainted, but from their habit of assembling in certain trees for parade during courtship it is to be inferred that similar results to those always incident to such assemblages among polygamous species are likely to occur. The activity and flight-power of birds of paradise, according to Wallace, is remarkable, enabling them to escape their natural enemies; but during the pairing season the magnificent plumes of the three-year-old males render their flight more laborious and the

[5] See, however, account of battle between three males in Abbott's "Upland and Meadow," pp. 144, 145.

birds more conspicuous and liable to destruction. From our general knowledge of female preferences we must believe these highly-plumaged males more desirable than the plainly-colored two-year-olds;[6] but the percentage of the former to the latter is so very low that it is highly probable many females in their extremity "took hold of one" (figuratively speaking), preferring dishonor to the reproach of pairing with a less handsome bird. In view of the maximum development of the Paradiseidæ in their secondary sexual characters, an opposite course of selection on the part of the female would result in the regression of development to former obscurely-tinted male types, provided the unadorned males of the second year transmit to their offspring less distinctive secondary sexual characters than males of the third year. Such variability in the degree of transmission, when limited by age, is worth special study.

The conspicuous adornment of male polygamous birds, as I have said, exposes them to the scrutiny of their enemies, whereas the females, retaining their original protective colors, are still preserved. Another cause of male destruction is due to their greater value as prey, being larger and better favored than the opposite sex. These facts, coupled with their great destruction of each other, overbalance everything conducive to an increase of male birds and favor the preponderance of females, so that although a larger percentage of males be yearly produced, the law of survival, exclusively directed against them, perpetuates the inequality. Such, we exclaim, are the sad results of what may be termed psycho-physical development! Let not mankind sit in judgment here. The skirts of immortals are yet defiled by similar practices.

Before quitting this interesting subject we may discuss a few questions arising from the nature of our deductions.

Firstly,—among our native birds it is asserted that, after the turkey (*Melagris gallopavo*), the cock of the plains (*Centrocercus urophasianus*) and the pinnate grouse (*Cupidonia cupido*) practice polygamy to the greatest extent. It will be objected that the two

[6] See Wallace in *Annals and Mag. Nat. Hist.*, Vol. XX., on age of attainment of full male plumage in *Paridisea apoda*.

latter exhibit slight sexual dissimilarity, that their colors are obscure, and therefore the theory that distinctive secondary characters and strongly-marked sexual differences are necessary adjuncts to polygamous habit is disproved. This conclusion appears reasonable; but if we examine the sexes of both species during courtship the contrast between their respective males and females is very great, and the exhibition of secondary characters evident. In both the males possess large cervical appendages, which, during the reproductive period, assume a dark orange hue and are capable of voluntary inflation. In Centrocercus this distension is enormous, and observers who have witnessed the males at their leks assert that their natural appearance is thereby changed beyond recognition. In Cupidonia this inflation is further supplemented by overlying wing-like tufts, which, in connection with the crown and tail feathers, are erected on occasions of parade. Any one who will take the trouble and patience to observe these birds during the pairing season will not fail to wonder at the transformation of the cocks, and freely admit the possession by them alone of strongly characteristic sexual features. Worthy of remark, on the other hand, is the lack of these sexual differences in other nearly allied plain-haunting species, as exhibited by the monogamous red grouse and ptarmigan (*Tetrao scoticus* and *Lagopus albus*).

In the case of plain-loving species the results of sexual selection have been counteracted by the law of survival. So soon as any males became, in consequence of sexual selection, more conspicuous than the rest, they would be the most likely victims to beasts of prey by virtue of that superiority, while the less attractive would survive; and so the tendency toward high ornamentation would be thwarted as long as the species continued to exist under unaltered conditions of environment. The necessity of protective resemblance to many birds has thus exerted a controlling influence on sexual selection, and indirectly on polygamy itself.

The ability of organism to evade (so to speak) the laws of nature, or rather to compromise with conflicting laws, is curiously exhibited in the pinnate grouse. In it the selective tendency, in

accordance with the law which guided it toward specialization of color, finding its action at the outset nullified by the law of protective resemblance, made truce therewith, developing characters conformatory to both, first by modification of the form of plumes and addition of appendages of periodic color-brilliancy, and secondly by enabling the possessor of these characters to exhibit them at discretion, for in times of danger the wing-like neck tufts, previously employed to attract attention, in turn conceal the shrunken air-sacs from observation when depressed. Similar cases have produced other combinations of protective resemblance with high coloration, those parts of the body being most ornate which are screened from observation of other birds of prey, yet capable of voluntary display to an appreciative admirer, as many have witnessed in the sudden transformation of a passive, inconspicuous gobbler or peacock by mere erection and distension of certain parts.

If we premise that the original gallinaceous type from which the existing forms have sprung was an inhabitant of treeless plains of vast extent, the causes which have induced some to betake themselves to forests, while others clung to their original habitat, are difficult to surmise. Owing to well-recognized natural agencies, forest limits may have widely extended and at last invaded their haunts; or we may conjecture that migration, induced by climatic changes, was the cause of their first woodland experience. In either event the proximity of forests would result in the discovery by the birds of their value as a resort in times of danger, or for roosting purposes, or in the search of mast, when from any cause there was a scarcity of food stuffs in their accustomed feeding grounds. This would eventually remove the counter effects of the law of protective resemblance to sexual selection, and favor higher ornamentation, and thus, by slow degrees, the evolution of organic characters would progress simultaneously with a change of habits to accord with altered environment. The fact of the more gorgeously ornamented polygamists being forest-hunting species (witness the Menuridæ and Phasianidæ) is in full accord with our supposition. We may, on the other hand, attribute the continuance of Cupidonia and Cutrocercus in their orgi-

inal haunts to some physical peculiarity which became so strongly developed previous to any change in their secondary sexual characters as to necessitate a life on the barrens and prairie, and debar them from a woodland existence. *Centrocercus urophasianus* subsists wholly upon the buds of the Artemisia, which grows exclusively upon unwooded barrens and tablelands, and its gizzard has in consequence been so metamorphosed as to unfit it for the digestion of other food. Conditions none the less local and arbitrary may be discovercd to restrict *Cupidonia cupido* to a prairie life, despite the evident tendency of natural law to induce him to quit it for the forest.

In an investigation of this nature, the infinite complexity of organic life, the inscrutable interdependence of natural laws, and the mysterious sequence of past events rise before us in fuller revelation. Nature stands accused of a mysterious crime. There is no direct evidence in the case. History and precedent seem to fail us, but the present—never. It is the supreme court; its records are perpetual, its proofs infallible, and its judgment based on the testimony of ages. Our appeal is made, and we must wait, trusting that the future will justify what the past allowed.

RECORD OF AMERICAN ZOOLOGY.

BY J. S. KINGSLEY.

(Continued from Vol. XXIV., page 816.)

IT is the intention to catalogue here in systematic order all papers relating to the Zoology of North America, including the West Indies, beginning with the year 1889. An asterisk indicates that the paper has not been seen by the recorder. Owing to the method of preparation it is impossible to collect in one issue all the papers relating to any group, but it is hoped that succeeding numbers will correct this. Authors are requested to send copies of their papers to J. S. Kingsley, Lincoln, Nebraska.

ARTHROPODA.

WATASE, S.—On the morphology of the compound eyes of Arthropods. Studies Biol. Lab. Johns Hopkins University, IV., p. 287, 1890.—See AM. NAT., XXIV., p. 373, 1890.

CRUSTACEA.

FEWKES, J. W.—A new parasite of Amphiura. Proc. Bost. Socy., XXIV., p. 31.—A copepod in brood sac.

HAY, O. P.—Notice of a supposed new species of Branchipus from Indiana. Proc. A. A. A. S., XXXVIII., p. 286.—*B. gelidus.*

ARACHNIDA.

McCOOK, H. C.—Note on the true systematic position of the Ray Spider. Proc. Phila. Acad., 1889, p. 180.—Microepira Emerton = Theridisoma Cambridge. Notes on spinning habits.

WEED, C. M.—A descriptive catalogue of the Phalangiinæ of Illinois. Bull. Ill. State Lab. Nat. Hist., III., p. 79, 1889.—Describes ten species, of which *L. elegans*, *L. politus*, are new.

——A partial bibliography of the Phalangiinæ of North America, *l. c.*, p. 99, 1889.

"RILEY AND HOWARD."—A contribution to the literature of fatal spider bites. *Insect Life*, I., p. 204, 1889.—Case of poisoning from a bite of *Latrodectus mactans.*

WEBSTER, F. M.—Notes on a species of Bryobia infesting dwellings [in Indiana]. *Insect Life*, I., 277, 1889.

CORSON, E. R.—The spider bite question again. *Insect Life*, I., 280, 1889.—Six cases; none fatal.

BLANCHARD, A. D.—More evidence bearing on spider bites. *Insect Life*, I., 313, 1889.—One case.

RILEY, C. V.—The six-spotted mite of the orange. *Insect Life*, II., 225, 1890.—*Tetranychus 6-maculatus*, n. sp. from Florida.

COCKERELL, T. D. A.—*Phalangodes robusta*. *Can. Ent.*, XXI., p. 140, 1889.—Occurs in Colorado under logs.

Poison from spider bites. Discussion in Proc. Ent. Socy. Washington, I., p. 139, 1889.

MARX, G.—On a new and interesting spider from the United States. Proc. Ent. Socy. Washington, I., p. 166, 1889.—*Hypochilus thorelii* from Lookout Mountain, Tenn. (*vide Ent. Amer.*, IV., 160, 1888).

——On the importance of the structural characters of Hypochilus in the classification of spiders. Proc. Entom. Socy. Washington, I., p. 178, 1889.—A tetrapneumonous spider with dipneumonous features.

——On a new species of spider of the genus Dinophis from the Southern United States. Proc. A. N. S. Phila., 1889, p. 341, 1890.—*D. spinosus* (Alabama).

McCOOK, H. C.—American spiders and their spinning work. A natural history of the orbweaving spiders of the United States, with special regard to their industry and habits. Philadelphia, 1889, Vol. I., 4°, pp. 372.—A general account, largely of habits. Will need to be read in structural portions in connection with Apstein.

KINGSLEY, J. S.—The ontogeny of Limulus. AM. NAT., XXIV., p. 678, 1890.

WEED, C. M.—A new Phalangium. AM. NAT., XXIV., p. 783, 1890.

POTEAT, W. L.—A tube-building spider. Jour. Elisha Mitchell Sci. Socy., 1889.—Description of the tubes constructed by

Atypus niger, and account of the methods of capturing food and feeding.

WEED, C. M.—The black harvest spider. AM. NAT., XXIV., p. 683, 1890.

HEXAPODA.

HOWARD, L. O.—A commencement of a study of the parasites of cosmopolitan insects. Proc. Entom. Socy. Washington, I., p. 118, 1889.—Gives list of arthropods, with European and American parasites.

SWARTZ, E. A.—[Insect fauna of Florida.] Proc. Ent. Socy. Washington, I., p. 145, 1889.—Abstract showing relationships of semi-tropical Floridan hexapods.

WEED, C. M.—Studies in pond life. Bull. Ohio Exp. Sta., Tech. Series, I., p. 4, 1889.—Life-histories, habits, etc., of various hexapods.

WEED, C. M.—A partial bibliography of insects affecting clover, *l. c.*, p. 19, 1889.—List of 82 species, with references.

COCKERELL, T. D. A.—Some notes on Dr. A. R. Wallace's Darwinism. *Nature*, XI., 393, 1890.

OESTLUND, O. W.—On the reproduction of lost or mutilated limbs of insects. Bull. Minn. Acad. Sci., III., p. 143, 1889.—Absence of reproduction in hexapods; figures five-winged *Tremex*.

FORBES, S. A.—Sixteenth report of the State entomologist on the noxious and beneficial insects of the State of Illinois. Springfield, 1890.—Deals with chinch bugs, cornbill bugs (Rhynchophora), cut worms (Noctuidæ), meadow maggot (*Tipula bicornis*), burrowing web-worm (*Pseudanaphora arcanella*), and gives (p. 122) a bibliography of chinch bug.

COCKERELL, T. D. A.—Some insects common to Europe and Colorado. *Ent. Mo. Mag.*, XXV., 255, 1889.

——Entomological notes from Colorado. Ibid, p. 324, 1889.—Continuation of above, etc.

——Notes from Colorado. Ibid, p. 362, 1889.

——Asymmetry in insects. Ibid, 382, 1889.

——Evolution of metallic colors in insects. *Entom. News*, I., p. 3, 1890.—Absence of knowledge of causes of color.

ORTHOPTERA.

WHEELER, W. M.—The embryology of *Blatta germanica* and *Doryphora decemlineata*. *Jour. Morphol.*, III., p. 291, 1889.

BRUNER, L.—New North American Acrididæ found north of the Mexican boundary. Proc. U. S. Nat. Mus., XII., p. 47, 1889 [1890].—The forms described are *Mesops cylindricus* (Neb.), *Dracotettex* [n. g.] *monstrosus* (Cal.), *Ochrilidia* (?) *crenulata* (Neb. to N. Mex.), *O.* (?) *cinerea* (Neb. to Idaho), *Mermira texana* (Tex., Mex.), *M. maculipennis* (Tex.), *Syrbula acuticornis* (Tex.), *Eritettix* [n.g.] *variabilis* (New Mex.), *Boötettix* [n. g.] *argentatus* (Tex., Mex.), *Pedioscertetes pulchella* (Idaho), *Psolœssa buddiana* (Tex.), *P. eurotiæ* (Col.), *Arphia saussureana* (Cal.), *Aulocara scudderi* (Kan. to Saskatchawan), *Mestobregma pulchella* (Mont.), *Conozoa texana* (Tex.), *C. albolineata* (Cal.), *C. kœbeli* (Cal.), *Trimerotropis cyaneipennis* (Utah), *T. azurescens* (Mont., Ida., Wy.), *T. bifasciata* (Cal.), *T. californica* (Cal.), *T. modesta* (N. Mex.), *T. thalassica* (Cal.), *T. pacifica* (Cal.), *T. perplexa* (Neb.), *Circotettix lapidicolus* (Idaho), *C. shastanus* (Cal.), *Œdipoda* (?) *occidentalis* (Cal.), *Thrincus* (?) *avidus* (N. Mex.), *Th.* (?) *maculatus* (Cal.), *Haldemanella robusta* (Ariz.). A plate illustrates the paper.

COLEOPTERA.

SHERMAN, J. D., JR.—Notes on Coleoptera of Peekskill, N. Y., for 1887. Proc. Ent. Socy. Washington, I., p. 162, 1889.—Habits and food plants.

SCHWARTZ, E. A.—Notes on the food habits of some North American Scolytidæ and their Coleopterous enemies. Proc. Ent. Socy. Washington, I., p. 163, 1889.

——On a collection of Coleoptera from St. Augustine, Fla. Proc. Ent. Socy. Washington, I., p. 169, 1889.—Facies of fauna.

——Coleopterological notes. Proc. Ent. Socy. Washington, I., p. 174, 1889.—*Spæricus gibbus*, a museum pest; Scolytidæ on tamarack; sexes in Pissodes and Photinus; notes on Sinoxylon.

TOWNSEND, TYLER.—Twelve species of Coleoptera taken from stomachs of toads in Michigan, with remarks on the food habits of toads. Proc. Ent. Socy. Washington, I., p. 167, 1889.

WEED, C. M.—Preparatory stages of the 20-spotted lady bird. Bull. Ohio Exp. Sta., Tech. Series, I., p. 3, 1889.

——Studies in pond life, *l. c.*, p. 4, 1889.—Life-histories and habits of *Listronotus latiusculus*, *Donacia subtilis*, *Hippodamia 13-punctata.*

WHEELER, W. M.—The embryology of *Blatta germanica* and *Doryphora decemlineata. Jour. Morphol.*, III., 291, 1889.

FORBES, S. A.—Cornbill bugs [Rhynchophora] in 16th Rep. Entom. Ill., p. 58, 1890.—*Sphenophorus minimus*, n. sp.; figures of *S. ochreus*, *pertinax*, *robustus*, *scoparius*, *melanocephalus*, *placidus*, *parvulus.*

BLANCHARD, F.—Revision of the species of Cardiophorus Esch. of America north of Mexico. Trans. Am. Ent. Socy., XVI., p. 1, 1889.—Enumerates 31 species, the following new: *C. bifasciatus* (Cal.), *coxalis* (Oreg.), *pullus* (Colo.), *gemmifer* (Nev., Cal.), *abbreviatus* (Cal.), *angustatus* (Fla.), *nevadensis* (Nev.), *crinitus* (Cal.), *pubescens* (Wy., N. Mex., Colo.), *carbonatus* (Cal.), *seniculus* (Cal.), *dispar* (Cal.).

DIETZ, W. G.—On the species of Macrops Kirby inhabiting North America. Trans. Am. Ent. Socy., XVI., p. 28.—33 species, the following new: *M. indistinctus* (N. J. to Wy.), *cryptops* (Ga., Fla.), *hyperodes* (Cal.), *nevadensis* (Nev.), *gryphiodes* (Wy. to Tex.), *wickhami* (N. Mex.), *interpunctulatus* (Neb. to Tex.), *ulkei* (Dak., Wy., Tex.), *dorsalis* (Ill., La., Tex.), *tenebrosus* (Mont., Dak., Wy.), *alternatus* (Ill.), *montanus* (Ill. to Mont.), *interstitialis* (Or.), *hornii* (Ga., Fla.), *setiger* (Fla.), *subscribratus* (Fla.), *longulus* (Dak.), *rotundicollis* (Tex.), *obscurellus* (Tex., D. C.), *imbellis* (La., Wash. Terr.), *hirtellus* (Ariz., N. Mex.), *echinatus* (Mass. to Ariz.), *obstectus* (Ariz.), *myasellus* (Colo.), *mirabilis* (Ill.), *californicus* (Cal., Wash.), *anthracinus* (Fla.).

HAMILTON, JOHN.—Catalogue of the Coleoptera common to North America, Northern Asia, and Europe, with the distribution and bibliography. Trans. Am. Ent. Socy., XVI., p. 89, 1889. —484 species enumerated, 481 being common to Europe and America, 328 occurring in Asia. Notes are given on several species doubtfully referred to the North American fauna.

HORN, G. H.—Antennæ of Coleoptera. Proc. A. N. S. Phila., 1889, p. 311, 1890.—Seat of special sense.

COCKERELL, F. D. A.—Colorado Coleoptera. *Ent. Mo. Mag.*, XXV., p. 186, 1889.—List of finds.

LEWIS, G.—On a new species of Teretriosoma. *Ent. Mo. Mag.*, XXV., 397, 1889.—*T. horni* (Key West).

HORN, G. H.—Notes on Coleoptera. *Entom. News*, I., p. 9, 1890.—Separation of species of Cryptohypnus.

LIEBECK, CH.—*Phytonomus punctatus* Fabr. *Ent. Notes*, I., p. 12, 1890.—Abundant at Philadelphia (?)

HAMILTON, J.—Rare beetles on the New Jersey coast. *Ent. Notes*, I. p. 12, 1890.—*Cafius sericeus*, *Cryptobium pusillum*, *C. lugubra*, *Quedius brunneus*, *Actobius nanus*.

WICKHAM, H. F.—Notes from the northwest. *Ent. Notes*, I., p. 33, 1890.—Captures in Montana to Oregon and Victoria.

LUGGER, OTTO.—Fond of grammar. *Ent. Notes*, I., 38, 1890.—Larva of *Trogosita mauritanica* boring in books.

LIEBECK, C.—Notes on Coleoptera. *Ent. Notes*, I., 52, 1890.

HORN, G. H.—Notes on Elateridæ. *Ent. Notes*, I., 53, 1890.—Notes on Candeze's species, chiefly synonymical; *Megapenthes limbalis* is male, *M. granulosus* female; *Corymbites inflatus* male, *C. crassus* female.

HAMILTON, JOHN.—Balaninus: its food habits. *Can. Ent.*, XXII., p. 1, 1890.—Habits of *B. proboscideus*, *rectus*, *quercus*, *nasicus*, *caryæ*, *uniformis*, *obtusus*.

COCKERELL, T. D. A.—Notes on the insect fauna of high altitudes in Custer county, Colorado. *Can. Ent.*, XXII., p. 37, 1890.

COOK, A. J.—A new clothes beetle. *Can. Ent.*, XXI., p. 187, 1889.—*Lasioderma serricorne.*

*BOURGEOIS, J.—Deux malacodermes noveaux de l'Amérique meridional. Ann. Soc. Ent. France, VIII., 4 Trim. Bull., 176, 1889.—*Chauliognathus cardiaspis*, *Cantharis metallica*.

*BLANCHARD, F.—Observations on some variations of the males in Clinidium. *Psyche*, V., p. 165, 1889.

*WOODWORTH, C. W.—Trox at electric light. *Psyche*, V., p. 169.

SCHWARTZ, E. A.—On *Xyleborus pyri* and an undescribed allied species. Proc. Ent. Socy. Washington, I., p. 138, 1889.—Describes mines of *X. pyri* and of new (unnamed) species from Florida.

——On the types of *Tomicus limnaris* Harris. Proc. Ent. Socy. Washington, I., p. 149, 1889.—Shows that Harris confused *Hylesinus opaculus* with above. Gives Harris's notes on other Scolytidæ.

——Termitophilous Coleoptera found in North America. Proc. Ent. Socy. Washington, I., p. 160, 1889.—Enumerates nine species.

HORN, G. H.—A synopsis of the Halticina of boreal America, Trans. Am. Ent. Socy., XVI., 163, 1889.—An extensive (158 pages) paper, with numerous new species and the following new genera: Pseudolampsis, Phydanis, Hemiphrynus, Hemiglyptus, Leptotrix.

LONG, C. W.—Staten Island fireflies. AM. NAT., XXIV., p. 691, 1890.

HEMIPTERA.

HEIDEMANN, O.—Remarks on the Hemiptera collected by Mr. Schwartz in Dade county, Florida. Proc. Ent. Socy. Washington I., p. 142, 1889.—General account.

UHLER, P. R.—Observations on the Heteroptera collected in Southern Florida by Mr. E. A. Schwartz. Proc. Ent. Socy. Washington, I., p. 142, 1889.—95 species collected, the following new: *Acanthochila exquisita.*

WEED, C. M.—Studies in pond life. Bull. Ohio Exp. Sta., Tech. Series, I., p. 4, 1889.—Habits of *Zaitha fluminea*, *Notonecta indulata;* eggs of *Benacus grisea*, *Belostoma americanum.*

FORBES, S. A.—Studies on the chinch bug, II., 16th Rep. Entom. Ill., p. 1, 1890.

——Contribution to an economic bibliography of the chinch bug. 16th Rep. Entom. Ill., Appendix, 1890.

DISTANT, W. L.—Description of a new species of neotropical Capsidæ. *Ent. Mo. Mag.*, XXV., p. 202, 1889.—*Eccritotarsus exitiosus* (Trinidad).

COCKERELL, T. D. A.—*Coccus cacti* in Colorado. *Ent. Mo. Mag.*, XXV., 382, 1889.

WEED, C. M.—Siphonophora or Nectarophora. *Ent. Notes*, I., p. 20, 1890.—Former preoccupied.

GILLETTE, C. P.—*Abcanthia papistrilla* in nests of the barn swallow. *Ent. Notes*, I., 26, 1890.

*UHLER, P. R.—New genera and species of American Homoptera. Trans. Amer. Acad. Science for 1888–89, p. 33, 1889. —Mostly California forms.

DIPTERA.

FORBES, S. A.—The meadow maggots or leather jackets. 16th Rep. Entom. Ill., p. 78, 1890.—Larva of *Tipula bicornis*.

IVES, J. E.—An interesting method of egg deposition. *Ent. Notes*, I., p. 39, 1890.—Oviposition of Atherix.

LEPIDOPTERA.

AARON, E. M.—*Erebia epipsodea* var. *sine-ocellata*. *Ent. Notes*, I., p. 12, 1890.—Synonym of *E. epipsodea* var. *brucei*.

SLOSSON, A. T.—May moths in northern New Hampshire. *Ent. Notes*, I., p. 17, 1890.

SKINNER, H.—Random notes on Lepidoptera. *Ent. Notes*, I., p. 19, 1890.—Sex of Cecropia cocoons, male compact, lighter in color, and more slender; cocoons of Callosamia.

JONES, F. M.—Notes on *Smerinthus astylus* Drury. *Ent. Notes*, I., 21, 1890.—Life-history.

AARON, E. M.—North American Hesperidæ. *Ent. Notes*, I., 23, 1890.—First of series; descriptions of *Eurycides urania* West., and *Eudamus hesus* West., Southwest U. S.

SKINNER, H.—Notes on Lepidoptera. *Ent. Notes*, I., p. 51, 1890.—*Protoparci dalica* = *P. rustica*; *Phyciodes ianthe* = *Acca hera*; *Eresia taxana* = *Smerdis*. Questions distinctions of *Œnosanda noctuiformis* and *Cantethia grotei*; asks for type of *Arctia pallida*.

BEUTENMÜLLER, W., AND SKINNER, H.—[Spinning of *Callosamia angulifera*.] *Ent. Notes*, I., 58, 1890.

SKINNER, H.—Two new species of butterflies. Trans. Am. Ent. Socy., XVI., 86, 1889.—*Anartia dominica* (West Ind.), *Myscelia streckeri* (Lower Cuba).

RILEY, C. V.—Two brilliant and interesting Microlepidoptera, new to our fauna. Proc. Ent. Socy. Washington, I., p. 155, 1889.—Describes as new *Setiostoma fernaldilla* (Los Angeles, Cal.) and *Walsinghamia* [n. g.] *diva* (Florida).

WEED, C. M.—Studies in pond life. Bull. Ohio Exp. Sta., Tech. Series, I., p. 5, 1889.—Habits and life-history of *Arzama obliquata*.

FORBES, S. A.—Notes on cut worms. 16th Rep. Entom. Ill., p. 84, 1890.—Noctuids, several larvæ figured.

——The burrowing web worm. 16th Rep. Entom. Ill., p. 98, —*Pseudanaphora acanella.*

BARRETT, C. G.—Capture of *Hadena albifusa* Grote in Great Britain. *Ent. Mo. Mag.*, XXV., 180, 1889.

COCKERELL, T. D. A.—*Alucita hexadactyla* L. in Colorado. *Ent. Mo. Mag.*, XXV., 212, 1889.

SMITH, J. B.—*Hadena albifusa* Grote in Great Britain. *Ent. Mo. Mag.*, XXV., 228, 1889.

SKINNER, H.—Notes on butterflies found at Cape May, N. J., with description of a new species of Pamphila. *Entom. News*, I., p. 6. 1890.—*P. aaroni*, range of *Satyrus alope*, oviposition of *Terias lisa*, first stages of *Pamphila panoquin.*

SMITH, J. B.—Preliminary catalogue of the Arctiidæ of temperate North America, with notes. *Can. Ent.*, XXII., p. 9, 31, 1890.—Genera *Arctia.*

GROTE, A. R.—Note on the larval ornamentation of the N. Am. Sphingidæ. *Can. Ent.*, XXII., p. 15, 1890.

BEUTENMÜLLER, WM.—Descriptions of Lepidopterous larvæ. *Can. Ent.*, XXII., p. 16, 1890.—*Mamestra lorea, Phycis rubifasciella, Salebria contatella, S. celtella, Botys fissalis.*

GROTE, A. R.—Note on the genus Crocota and Prof. J. B. Smith. *Can. Ent.*, XXII., p. 17, 1890.—Controversial.

EDWARDS, W. H.—Description of a new species of Melituca from Southern California. *Can. Ent.*, XXII., p. 21, 1890.—*M. augusta.*

GROTE, A. R.—The Noctuidæ of Europe and North America compared [continued]. *Can. Ent.*, XXII., p. 26, 1890.

COCKERELL, T. D. A.—*Erebia epipsodea* var. *sine-ocellata. Can. Ent.* XXII., p. 40, 1890—(?) var. *brucei.*

BEUTENMÜLLER, WM.—Description of the larva of *Trirhabda tormentosa. Can. Ent.*, XXII., p. 36, 1890.

RILEY, C. V.—Notes on Pronuba and Yucca pollination. Proc. Ent. Socy. Washington, I., p. 150, 1889.—Largely controversial.

BLAKE, C. A.—Hop-worms. *Ent. Notes*, I., p. 43, 1890.—Larva of *Gortyna nitela.*

Edwards, H.—Bibliographical catalogue of the described transformations of North American Lepidoptera. Bulletin U. S. Nat. Mus. No. 35, pp. 147, 1889.—References to early stages of 1069 species.

Smith, J. B.—Contributions toward a monograph of the Noctuidæ of temperate North America.—Revision of some Tæniocampid genera. Proc. U. S. Nat. Mus., XII., p. 455, 1889 [1890].—The genera included are Barathra, Trichoclea, Scotogramma, Ulolonche, Himella, Crocigrapha, Orthodes, Tæniocampa, Perigrapha; no new species.

Taylor, W. E.—Preliminary catalogue of and notes on Nebraska butterflies. Am. Nat., XXIII., p. 1024, 1889 [1890].

HYMENOPTERA.

Harrington, W. H.—Tenthredinidæ collected at Ottawa [Canada], 1889. *Can. Ent.*, XXII., p. 23, 1890.

Cockerell, T. D. A.—Notes on the insect fauna of high altitudes in Custer county, Colorado. *Can. Ent.*, XXII., p. 37, 1890.

Harrington, W. H.—The corn saw fly. *Can. Ent.*, XXII., p. 40, 1890.—*Cephus pygmæus* at Ottawa and Buffalo.

*Gillette, C. P.—Notes on certain Cynipidæ, with descriptions of new species. *Psyche*, V., 183, 1889.

Robertson, C.—Notes on Bombus. *Ent. Notes*, I., p. 39, 1890.—Distinctness of *B. americanorum* and *B. pennsylvanicus*; *Apathus elatus* male of first.

Hamilton, J.—The inhabitants of a hickory nut gall. *Ent. Notes*, I., 49, 1890.—*Pimpla, Phanerotoma tibialis.*

Cresson, E. T.—[In above, p. 50].—Describes as new *Pimpla grapholithæ* from Missouri.

Robertson, Ch.—Synopsis of North American species of the genus Oxybelus. Trans. Am. Ent. Socy., XVI., p. 77, 1889.—14 species; new are *O. subulatus* = *mucronatus* Pack. (Penn. to Mont.), *cornutus* (Mont.), *packardii* = *lactus* Pack. (Ill., Tex.), *sericus* (Ill.), *fulvipes* (Fla.), *niger* (Ill.), *cressonii* (Ill.), *mexicanus* (Mex.), *frontalis* (Pa., Ill., Tex.), *forbesii* (Colo.).

Ashmead, W. H.—Descriptions of new Ichneumonidæ in the collection of the U. S. National Museum. Proc. U. S. Nat. Mus.,

XII., p. 387, 1890.—No new genera are characterized. Keys are given of the species of Eristicus, Hemiteles, Cryptus, Orthopelma, Limneria. Many new species are described.

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

ABOUT fifty years ago the British Association for the Advancement of Science adopted certain rules for the guidance of nomenclators in science. These rules were based partly on customs which had become prevalent, but all were designed to secure fixity in consonance with the other interests of science. These other interests of science may be embraced under two heads: First, the maintenance of a high standard of scientific work; second, justice to the investigator. In accordance with these views, fixity is secured by the strict adhesion to the law of priority, without exception. The standard of scientific work is sustained by the requirement that names adopted shall represent work done or ideas worked out, and not prospective discoveries to be made or not made at some future time. Justice to the investigator is secured by the two requirements just mentioned, viz., that the originator of ideas and the discoverer of facts, and not some other person, shall be credited with them.

These rules have been carried more and more fully into practice as time has advanced. The American Association in 1876 adopted similar rules, and the Congress of Zoologists of Paris has followed the same example. The attempts made by scientists holding important positions in the governmental or other educational organizations to ignore and override the work of private and perhaps humbler citizens, which were not uncommon in the early part of this century, have fallen to the ground. In fact, we are now confronted with the opposite extreme, viz., the dis-

position to recognize pretenders to scientific research who do not fulfil the requirements of the second of the ends above mentioned, which a healthy nomenclature has in view. It is in this democratic country that this danger has arisen, in the adoption by some naturalists of the opinion that names are to be adopted which represent nothing, and which should therefore never be regarded as a part of scientific literature. The result to science is quite the same as that produced by the autocratic practices of official scientists of a half century ago, viz., the encouragement of pretence and the discouragement of work. The only difference is that all kinds of shams are recognized, and not only official shams. We have here an illustration of the close affinity between mobocracy and aristocracy. Indeed, they may harmonize perfectly under the system referred to. We are reminded of the song in Madame Angot's Daughter:

Jadis les rois une race proscrite
Enrichissait leurs partisans
Ils avaient mainte favorites
Et cent mille courtezans.

* * * *

Mais Barras est roi et Lange est sa reine,
Il n'ait pas la peine, il n'ait pas la paine,
Il n'ait pas la paine assurement
Changer le gouvernement!

It was indeed scarcely worth while to adopt rules if we were to be transferred from official monopolists to lexicographers and catalogues of gardeners and dealers in butterflies, bird-skins, and shells!

The rules for the correct construction of scientific names are based on ordinary classical orthography, which needs only to be known to be followed. Yet this is often ignored, not only in America but in Europe, in the most glaring manner. Thus, hybrid names have been repeatedly constructed, such as Venustodus and latirhinus, and they cannot be set aside if put forth as the expression of good scientific work. Classical accomplishment is not of course science, but it is a pity to have scientific literature defaced by such exhibitions of ignorance. The fact that such

names can only be changed, if at all, by their authors, should make nomenclators careful. Attention to euphony is recommended in the rules. Names should be pronounceable or usable, otherwise they are liable to be set aside in familiar converse if not in the systems. Thus we have Homalodontotherium, of unnecessary length; Propalaehoplophorus, which is almost unpronounceable; Neeuryurus and Hipphaplous, still worse. And all this where endless opportunities for the construction of names, both short and euphonious, exist.

A reform is needed in some quarters in the matter of complimentary names. The object of naming a species or genus after a person is to compliment that person, and in order that it shall do so some care in the use of the method should be observed. The undiscriminating use of it of course destroys it as a compliment. But it is an easy way of escaping the necessity of constructing a suitable classical name on the part of persons who never studied Latin. One abuse of the custom we refer to specifically, and that is the habit, seemingly very common, of naming species after deceased persons. Such persons do not appreciate the compliment.

—THE peculiarities of an admixture of science and politics are exemplified in the case of Indiana. The last Legislature made the office of State Geologist an elective one, and this year all four parties nominated candidates for the office. The result is not one to commend itself to the scientific mind. The Republicans nominated a good *botanist* for the position; the other parties put up nobodies for the office. In any event the office would not be filled by a trained geologist. Bad as this state of affairs is, it is no worse than when the officer was appointed. It is but a few years since a mediocre poet and lawyer, without an iota of geological knowledge, was rattling around in the position. There are some geologists in the State, but somehow the politicians will have none of them.—K.

—IT is a well-known fact that there is not a little pretty poor science teaching in America, but in many schools this is not to be wondered at, for the pay is correspondingly poor. A certain Ohio

school advertises for an "Assistant Professor of Chemistry, Physics, and Biology; salary $600, with distinct understanding that all salaries for faculty are deducted pro rata if income is not sufficient to pay in full." What can they expect? Doubtless the institution will get all they pay for, but there is another aspect to the question. Are the poor students rightly treated by having their science taught them by such an intellectual smooth-bore as this advertisement calls for?

—A "PROMINENT BOTANIST" sets up a wail in the September number of the *Botanical Gazette* because (so he claims) the zoologists have appropriated and misapplied the term biology. In many a school "Biology" is taught, but the study is all devoted to the animal side of the living world. This is admittedly so, and on a broad etymological basis the use of the word in this way is wrong. Still the zoologists are not wholly without excuse. Fully half of the teachers of botany are utterly unable to give any of the living side of their subject. Analysis is all that they know, and so when the zoologist goes as far as he can, and teaches all that there is taught of life, is he to be blamed for claiming the name?

RECENT BOOKS AND PAMPHLETS.

FRAZER, P.—On a Specimen of Quartz from Australia and Three Specimens of Oligoclase from North Carolina Exhibiting Curious Optical Properties.

——An Unjust Attack. Ext. *Am. Geol.*, Jan., 1889. From the author.

GARMAN, H.—A Preliminary Report on the Animals of the Waters of the Miss. Bottoms, near Quincy, Ill. From S. A. Forbes.

GAUDRY, A.—Le Dryopithèque. Memoire I. de la Soc. Geol. de France. From the author.

General Account of the Instruction and Equipment in the Dept. of Geology at Harvard University, 1890.

GEIKE, J.—The Evolution of Climate. From the author.

GILBERT, G. K.—The History of the Niagara River. Ext. from Sixth Ann. Report Com. State Res. at Niagara. From the author.

GREEN, A. H.—Consolidation of Areas about the City of New York Under One Government. From the author.

LAWSON, A. C.—Note on the Pre-Paleozoic Surfaces of the Archean Terranes o Canada.—The Internal Relations and Taxonomy of Archean of Central Canada. Ext. Bull. Geol. Soc. Am., Vol. I., pp. 163–194. From the author.

LEA, H. C.—The Endemoniadas of Queretaro. From the author.

LEWIS, H. C.—The Terminal Moraines of the Great Glaciers of England. Ext. Proc. British Association, Sept. 1887. From the author.

LINTNER, J. A.—Report on Insects of the State of New York. From N. Y. State Mus. Nat. Hist.

MCGEE, W. J.—The Geological Antecedents of Man in the Potomac Valley. Reprint *Am. Anthropologist*, Vol. II., 1889.—The World's Supply of Fuel. Ext. *Forum*, Vol. VII., 1889. From the author.

MINOT, C. S.—Segmentation of the Ovum, with Especial Reference to the Mammalia. Ext. from the AM. NAT., June, 1889. From the author.

OLIVER, G.—On Bedside Urine-Testing. From the author.

Organization of the Geological Society of America. Bull. Geol. Soc. Am., Vol. I., pp. 1–86.

OSBORN. H. F.—A Review of the Cernaysian Mammalia. Reprint from Proc. Phil. Acad. Nat. Sci., May, 1890.

——Additional Observations upon the Structure and Classification of the Mesozoic Mammalia. Ext. Proc. Phila. Acad. Nat. Sci., Oct., 1888.

——The Origin of the Corpus Callosum, a Contribution upon the Cerebral Commissures of the Vertebrata. Reprint from *Morphologisches Jahrbuch*, Band XII. From the author.

PARKER, J. T.—Preliminary Notes on the Development of the Skeleton of Apteryx. Ext. Proc. Roy. Soc. From the author.

PARKER, W. K.—On the Presence of Claws in the Wings of the Ratitæ. From *The Ibis*.

——On Remnants or Vestiges of Amphibian and Reptilian Structures found in Skulls of Birds, both Carinatæ and Ratitæ. Reprint from Proc. Roy. Soc.

——On the Secondary Carpals, Metacarpals, and Digital Rays in the Wings of Existing Carinate Birds.—On the Vertebral Chain of Birds. Exts. from Proc. Roy. Soc., Vol. XLIII. From the author.

POTTS, ED.—Report upon Some Fresh-Water Sponges from Florida. Ext. Trans. Wagner Free Inst. Sci., Vol. II. From the author.

Proceedings of the Department of Superintendence of the National Educational Association, 1889.

QUILTER, H. E.—The Rhætics of Leicestershire. Ext. Trans. Leic. Lit. and Philosoph. Soc., 1889. From the author.

Report of the Committee on the International Congress of Geologists. Ext. Proc. Am. Ass. Adv. Sci., Vol. XXXVIII.

Report of the New York State Museum of Natural History, 1888.

REYES, A. DE LOS.—Arte en Lengva Mixteca.

ROTH, S.—Beobachtungen über Entstehung und Alter der Pampasformation in Argentinian. Abdruck a. d. Zeitschr. d. Deutsch. Geolog. Gesellschaft, Jahrg., 1888. From the author.

RYDEP, J. A.—The Phylogeny of the Sweat Glands.—Proofs of the Effects of Habitual Use . . he Modification of Animal Organisms. Exts. Proc. Amer. Philos. Soc., Vol. XXVI., 889

——A Physiological Hypothesis of Heredity and Variation. Reprint from AM. NAT., Jan., 1890.

——The Eye, Ocular Muscles, and Lachrymal Glands of the Shrew-Mole. Reprint Proc. Amer. Phil. Soc., Vol. XXVIII., 1890. From the author.

SHALER, N. S.—Tertiary and Cretaceous Deposits of Eastern Massachusetts. Bull. Geol. Soc. of America, Vol. I., pp. 443–452. From the author.

——The Topography of Florida. Bull. Harvard Mus. Comp. Zool., Vol. XVI., No. 7. From A. Agassiz.

SHANNON, W. P.—A List of the Fishes of Decatur County, Ind. From the author.

STEJNEGER, L.—Description of Two New Species of Snakes from California.—Contribution to the History of Pallas' Cormorant. Exts. Proc. U. S. Nat. Mus., Vol. XII. From Smithsonian Institution.

——Notes on a Third Collection of Birds made in Hawaiian Islands by Valdemar Kundsen. Ext. Proc. U. S. Nat. Mus., Vol. XII. From the author.

Studies from the Biological Laboratory of Johns Hopkins University, Vol. IV.

THURSTON, EDGAR.—Notes on the Pearl and Chalk Fisheries and Marine Fauna of the Gulf of Manaar. From the author.

TODD, D. P.—Provisional List of Mammals of Angola and Vicinity.—Terrestrial Physics. Bulls. Nos. 7 and 11, U. S. Scientific Expedition to West Africa, 1889. From the author.

TURNER, W.—Cell-Theory, Past and Present. Address to the Scottish Microscopical Society, 1889. From the author.

WASMUTH, H. A.—Notes on the Pittsburgh Coal-Bed and its Disturbances. Ext. from the *Am. Geol.*, May, 1888.—Studies on the Stratification of the Anthracite Measures of Penna. Ext. Journ. Franklin Inst., Vol. CXXIV., Aug., 1887. From the author.

WEED, C. M.—Biological Notes on Some North American Ichneumonidæ.—Second Contribution to a Knowledge of the Autumn Life-History of Certain Little-known Aphididæ. Ext. from *Psyche*, Vol. V. From the author.

WHITMAN, C. O.—Some New Facts about Hirudinea. Reprint from the *Journal Morphology*, Vol. II., No. 3, April, 1889. From the author.

RECENT LITERATURE.

G. H. Williams's Elements of Crystallography. Holt & Co., New York., 1890, pp. VIII., 250, Figs. 383.—At last mineralogists—practical specialists as well as teachers—are to be congratulated on the appearance of a treatise which discusses the numerous forms of crystallography in such a logical manner that they need no longer confuse the mind or bother the student. Dr. Williams has given us the first clear statement of the beautiful truths of crystallography that has appeared in English. Not only has he done this, but he has produced the best concise treatise on the subject that has anywhere appeared. In this country there has long existed a demand for a connected description of the relation of the various crystallographic forms to each other, in order that the excellent discipline afforded by the methods used in developing these from each other might be availed of in college instruction.

All who have studied crystallography as a system are agreed that no subject exists which has a higher value than this as a corrector of loose thought and hasty expression. Its tardy introduction into the curricula of our colleges has been due more to the lack of a good text-book than to anything intrinsically hard in the subject itself. Happily there is no longer an excuse for the neglect of this important science. The little book before us comprehends within its small volume all of the most essential principles of the science. It is well written, concise in expression, clear in the statement of the thought, and logical in the development of the ideas contained in it.

It opens with the discussion of the molecule, takes up in order the general principles underlying crystallography, treats each of the seven systems in detail, tells something about crystal aggregates, and describes the various methods made use of in the graphical representation of crystals. Both the Naumann and the Miller systems of nomenclature appear side by side whenever the symbol of a plane or form is needed, and so the reader is brought into frequent contact with these two rival claimants for ascendency. The notion of symmetry is everywhere emphasized, and this it is that gives the treatise its logical connection. The book is very well illustrated. It contains few typographical errors, and in general make-up it leaves but little to be desired.

The publishers, as well as the author, deserve the commendation of all mineralogists for their successful attempt to place before the English-reading public a volume which shall be worthy of their unqualified

approbation. It is to be hoped that their venture (for it is a venture to place upon the market such an expensive book as this must have been at such a low price) will prove no less profitable financially than it has proved excellent from a scientific and bibliographic point of view.

We expect an immediate adoption of the book by all the leading colleges in the country, not only because of the importance of the subject of which it treats, but also because of its excellent qualities as a treatise.—W. S. B.

Britton's Catalogue of New Jersey Plants.[1]—This thick volume of 642 octavo pages is one of which the botanists of the country may well feel proud, inasmuch as it is the most complete of any yet attempted in the United States. From the table in the end of the volume we learn that there are:

Anthophyta	1,919	species	and	varieties.
Pteridophyta	76	"	"	"
Bryophyta	461	"	"	"
Thallophyta	3,021	"	"	"
Protophyta	164	"	"	"
Total	5,641	"	"	"

The preface states that "the present work is based, so far as the flowering plants, ferns, and fern allies are concerned, on specimens actually seen and examined by myself, and contained in the State Herbarium above alluded to, or in other collections of repute. The lists of lower plants have been supplied by specialists of high reputation and authority." It is thus an authoritative catalogue, which is susceptible of correction, if need be, at any time in the future.

In discussing the distribution of the plants of the State the author refers to the rocky and mountainous areas of the northeastern portion, the glacial drift of the same region, the lower level of the southern part, and the much greater sandiness of its soil. "Our flora may thus be divided with considerable accuracy into a northern and a southern, whose present distribution has been determined by differences of soil and climate." These are separated by the glacial terminal moraine. "Besides these two main divisions of our flora, there is another, which may be termed the marine and coast group of plants,—species and varieties especially characteristic of the sea-beaches and salt and brackish

[1] Catalogue of Plants Found in New Jersey. (From the final report of the State Geologist, Vol. II.). By N. L. Britton, Ph.D., with the assistance of the botanists of the State and contiguous territory, and of specialists in the several departments of the science. Trenton, N. J.: Printed by The John L. Murphy Publishing Company, 1889.

marshes and meadows. Some of these are plainly forms of upland origin which have accommodated themselves to their saline surroundings, and been thereby slightly changed in structure and appearance, so as now to be evidently distinct from their inland neighbors and relatives, while others appear to be very distinct from any other living forms."

The sequence of the orders of flowering plants is that adopted by Bentham and Hooker in their "Genera Plantarum," with the exception that "the class Gymnospermæ has been moved into its more natural position at the extreme end of the flowering-plant series, and immediately before the fern allies, with which it has more affinity than with the willows and poplars, next to which it has generally been placed." In the citation of names the law of priority is rigidly followed, "the oldest specific or varietal name available being retained, in whatever genus the plant is located, or whatever its rank as species or variety." As to the double citation of authorities the author says: "The method adopted of citing the original author of the specific or varietal name—the only permanent portion of the binomial—in a parenthesis tells us who first named the plant, while the added name behind the parenthesis shows who first brought the names together in their present combination. This method has, with slight modifications, been generally adopted by zoologists and by students of fungi, algæ, lichens, and mosses, and its general use in botany tends to bring all biological nomenclature into harmony."

It may be of interest to note some of the changes of names to be observed in this catalogue, as follows:

Anemone pennsylvanica L. (of Gray's Manual) = *A. dichotoma* L.

Nymphæa odorata Ait. (of Gray's Manual) = *Castalia odorata* (Dryand.) Greene.

Nymphæa reniformis DC. (of Gray's Manual) = *C. tuberosa* (Paine) Greene.

Nuphar advena Ait. f. = *Nymphæa advena* Soland.

Nuphar kalmianum Ait. = *Nymphæa microphylla* Pers.

Dicentra is given as *Diclytra*.

Adlumia cirrhosa Raf. = *A. fungosa* (Ait.) Greene.

Acer saccharinum Wang. = *A. saccharum* Marsh.

Acer dasycarpum Ehrh. = *A. saccharinum* L.

Carya alba Nutt. = *Hicoria ovata* (Mill.) Britt.

Carya tomentosa Nutt. = *H. alba* (L.) Britt.

Carya microcarpa Nutt. = *H. microcarpa* (Nutt.) Britt.

Carya porcina Nutt. = *H. glabra* (Mill.) Britt.

Carya amara Nutt. = *H. minima* (Marsh.) Britt.
Leersia virginica Willd. = *Homalocenchrus virginica* (Willd.) Britt.
Leersia oryzoides Swartz = *Homalocenchrus oryzoides* (L.) Poll.
Phragmites communis Trin. = *P. vulgaris* (Lam.) B. S. P.
Chamæcyparis sphæroidea Spach. = *C. thyoides* (L.) B. S. P.
Pinus inops Ait. = *P. virginiana* Mill.
Pinus mitis Michx. = *P. echinata* Mill.
Picea nigra Link. = *Picea mariana* (Mill.) B. S. P.
Larix americana Michx. = *L. laricina* (DuRoi) B. S. P.

Many other changes might be cited, but these will serve to show the treatment of the vexed question of nomenclature and synonymy. While some of the changes are quite startling and uncomfortable, there can be little doubt that a rigid enforcement of the "law of priority" will eventually result in a greater fixity of names than now exists.—Charles E. Bessey.

The West American Oaks.[1]—Dr. Albert Kellogg began the preparation of a series of drawings to illustrate the oaks, pines, and other trees of the Pacific coast of the United States, intending to accompany them by appropriate descriptions, but death closed his work long before it came to completion. Now, through the munificence of Mr. McDonald and the aid of Professor Greene, the work is brought out in an appropriate form.

The first species figured and described is *Quercus kelloggii* Newberry, which bears a strong resemblance to the eastern red oak (*Q. rubra*). It is the *Q. sonomensis* Benth. of DeCandolle's "Prodromus." Then follow *Q. morehus* Kellogg, *Q. wizlizeni* A.DC., and *Q. agrifolia* Nee, all apparently related, although the first is deciduous and the others evergreen. *Q. hypoleuca* Engelm. is a narrow-leaved species quite distinct from the preceding. *Q. garryana* Dougl. and *Q. lobata* Nee, are closely related, and resemble the white oak of the eastern United States. The last-named species is the *Q. hindsii* Benth. of the Pacific Railroad Reports. *Q. gambelii* Nutt. is still more like the white oak, both in leaf and acorn. It is a shrub of six to eight feet in height, or a middle-sized tree from thirty to sixty feet high, with a trunk three feet in diameter. The tree form is confined to the "middle and higher elevations of the mountains of southern New Mexico and Arizona, and of adjacent Mexico." The smaller form occurs upon

[1] Illustrations of West American Oaks. From drawings by the late Albert Kellogg, M.D., the text by Edward L. Greene. Published from funds provided by James M. McDonald, Esq., San Francisco, May, 1889. 4to, pp. xii + 47, with XXIV. plates.
West American Oaks. Part II., San Francisco, June, 1890, pp. 52 to 84, with plates XXV. to XXXVII.

lower ground from central Colorado and Utah to the borders of Texas and Mexico. It is the *Q. alba* var. *gunnisoni* of Torrey, the *Q. douglasii* var. *gambelii* of A. DeCandolle, and the *Q. undulata* var. *gambelii* of Engelmann.

Of the remaining species the most notable are *Q. chrysolepis* Leibmann and *Q. densiflora* Hook. and Arnott, the latter evidently related to the chestnut (Castanea), both in foliage and fruit. The former enjoys the distinction of being "the most valuable oak of the Pacific forests." Like many other western species, it has passed under several other names, viz., *Q. pulvescens* Kellogg, and *Q. crassipocula* Torrey.

The second part of the work contains plates of ten species and varieties never before figured. It is a supplement to the work of the lamented Kellogg, and is most fittingly added to it. The newly-figured species are: *Q. palmeri* Engelm., *Q. turbinella* Greene, *Q. tomentella* Engelm., *Q. macdonaldi* Greene, and its variety *elegantula* Greene, *Q. fendleri* Leibmann, *Q. jacobi* R. Brown Campst., *Q. gilberti* Greene, *Q. venustula* Greene, *Q. dumosa* forma *polycarpa* Greene.—Charles E. Bessey.

The Flora of Nebraska.[3]—Nebraska has an interesting flora. Its geographical position, stretching from the mountains on the west across the arid plains to the rich prairies on the east, and a midway latitude between north and south, is strong indication of the fact. The well-known catalogue of Nebraska plants by Samuel Aughey, published fifteen years ago, upon data now known to have been sadly defective, contained such a wealth of plant names that it has led botanists ever since to believe in the superior richness of the flora.

The really earnest and careful study of the State flora dates from the connection of Professor C. E. Bessey with the State University at Lincoln. Upon his entrance into the State the collection of a representative herbarium was begun, together with a study of the economic features of the vegetation. Valuable papers upon different portions of the work have been published from time to time, the latest of which is given in the Annual Report of Nebraska State Board of Agriculture for 1889, recently issued.

This paper is the official report of the botanist to the board, and covers 160 pages. The first part is an account of the grasses and forage plants of Nebraska, in which many practical suggestions and comments are introduced. So far 106 native species are known within the State, and 22 kinds that have been introduced as weeds. The

[3] The Grasses and Forage Plants of Nebraska. By Charles E. Bessey, Ph.D. Catalogue of the Flora of Nebraska. By Herbert J. Webber, M.A. In Report of the Nebraska State Board of Agriculture for 1889. Lincoln, 1890.

cultivated grasses and some of the forage plants also receive attention; and notes upon cultivation, use of irrigation for meadows, diseases of grasses, and other topics make the report of great value to the Nebraska farmer. In the preparation of part of the topics Professor Bessey has been assisted by his pupils, Herbert J. Webber and Jared G. Smith.

The second part of the report is a catalogue of the flora of Nebraska, prepared by Mr. Webber under Professor Bessey's direction. This is in every way an admirable local flora. It embraces all manner of plants from the humblest protophyte to the most exalted anthophyte. The total number of species listed reaches (by a curious coincidence) 1890. From Professor Bessey's well-known views certain things among the departures from the commonly-accepted form in local floras, such as the arrangement of groups in an ascending order, the use of "phyta" as a uniform termination for the names of the grand divisions, and the decapitalization of specific names, were to be expected; but in the present instance we meet with an unlooked-for innovation in the use of Luerssen's arrangement of the phanerogams instead of one of the common American or English systems. This abolishes the division of Apetalæ, distributing the orders of this group according to their affinities, and brings the Compositæ at the end of the list as representing the highest development of plant life. Many minor changes of arrangement will be noted by the student, and especially the attempt to follow the most advanced views in both arrangement and nomenclature.

A feature of the work to which too much praise cannot be accorded is the indication under each species of the particular herbarium in which the specimen on which the determination was made can be found. This makes it possible to re-examine the data for any part of the catalogue desired, should the necessity for doing so ever arise. Could this practice be made universal the days of slight appreciation of local lists would soon be past, and they would become an important factor in the study of geographical distribution, etc., instead of being largely ignored as heretofore.

Further interesting features of this catalogue might be mentioned. It will undoubtedly serve as a model for other collectors who are ambitious to embody the results of the latest studies in their local lists, a desire which should not be discouraged.—J. C. ARTHUR.

Physikalische Krystallographie,[4] by Dr. Th. Liebisch, is an excellent treatise on the physical properties of crystals as distinguished from uncrystallized bodies. An introduction of fifty pages discusses the differences between crystallized and uncrystallized substances, and

[4] Leipzig, Veit and Comp., 1891, pp. VIII., 614, 298 fig., 9 tables.

the characteristics of the crystallographic systems. Then follows a statement of the deformations suffered by crystals under the influence of various agencies. The thermal, electric, and magnetic properties of crystallized material is next described in great detail, no less than one hundred and thirty-eight pages being devoted to these subjects. The optical properties of these bodies are next considered, and two hundred and sixty-three pages are occupied in their treatment. Elasticity is next discussed in a separate chapter, while the tenth and final chapter treats of the relations existing between the elastic, optical, and the electric properties of crystals.

Although the discussions are, on the whole, too mathematical for most mineralogists, there is much material in the book that will prove of great value to them; while the mathematical portion should be very welcome to physicists, who pay far too little attention to the physical properties of that most important class of bodies,—crystalline substances.—W. S. B.

The Catalogue of Minerals[5] published by Messrs. George L. English & Co., Philadelphia and New York, is not merely a catalogue of specimens offered for sale by the above firm, but it is also a handbook of the new and rare minerals recently found in the United States and other parts of America. About thirty pages of the little volume are reprints of the descriptions of these minerals as found in the original articles of the authors first describing them. Following these is a classified list of minerals, with their composition and crystallization. Finally, an alphabetical index to mineral names completes the volume, which is such an excellent little compendium of matters mineralogical that it will surely find a place upon the shelves of all lovers of minerals. Bound copies of the catalogue we believe are for sale by the publishers at a nominal price.—W. S. B.

WE have received from Burnz & Co., of 24 Clinton Place, N. Y., a pamphlet with the the modest title of "Diana," by Mrs. E. B. Burnz. The wisdom which is therein set forth consists of a theory of the sexual nature of man which divides its manifestations into two categories, one functional, the other affectional. The author sets forth her belief that the latter of these is the proper outlet for surplus sexual energy, and that proper gratification of the affectional desires would operate as a safety-valve, so to speak, in preventing abnormal outbreaks of the desire for the functional manifestations. This proposition must stand or fall by the facts of the human organism, mental and physical, as we find them. We admit that the pamphlet brings an obstacle to its reception along with it in the new phonetic spelling which the author has adopted. However, we would not have this prejudice sturdier readers from attempting to judge for themselves.

[5] Fifteenth Edition, June, 1890, pp. 100.

General Notes.

GEOGRAPHY AND TRAVEL.

(*Continued from page 946.*)

Honduras.—Still rising before us are numerous peaks and mountains in different forms. We notice that their tops are crowned by huge barren rocks,—a porphyritic cap. Before ascending these heights we are enabled to trace, in our imagination, the original magnitude and extent of this formation, now only left to us in huge rounded masses or other peculiar forms, in the shape of walls or even columns. Some of the summits have disappeared, but we will find them as debris accumulated at the base. The lithological character of this debris answers in every respect to those rocks, which have remained as monuments of a nearly-destroyed rock-formation once crowning the heights of the Pacific slope of Honduras.

The surface of the mountains is deeply ravined and supplied with creeks, and deep gulches separate the once coherent mountain masses. These wide gulches and river beds are as characteristic of Honduras as the absence of narrow canyons.

The presence of gulches and the absence of narrow cañons in that country is caused by the extreme variation of the water supply by rains in this tropical zone, and its steep slope, producing rapid drainage.

By aid of heavy rains streamlets may pass into torrents, and later into floods, demanding a large area for their agitated waves, which rapidly sweep down the steep slope of the mountain region. There is no rock material in existence which could restrict the suddenly-aroused masses of water into a small or limited area. The surrounding and enclosing rocks are dislocated and carried away till the fierce element has satisfied its demands.

Meteoric events are thus the makers of scenery; the latter will change as soon as the former will assume other conditions, and therefore they are in close relation to each other.

I make a few remarks about the present climatic condition of Honduras. Contrary to ordinary or common belief, Honduras has a a salubrious, healthy climate. The thermometer rises on the low coastlands from 80° up to 100°, but the latter quotation may be considered as one of the high extremes. In an altitude of 2,500 feet we will

encounter a constant temperature of about 75–90° F. the whole year round. At 3,500 feet, for example, the altitude of the capital of Honduras, Tegucigalpa, is 70–80° F.; and at Santa Lucia, 4,500 feet, a temperature of 68–75° F. The yearly variation of the already-mentioned places is between 10–15° F., whilst their daily difference is about 5° F. Towards evening northern breezes set in regularly, and render the nights pleasant and comfortable.

The rainy season commences on the Pacific side towards the latter part of April. Heavy showers of rain, accompanied by the constant rolling of thunder and the blinding flash of lightning, occur towards evening, and usually last during the night. The following day is bright, with pure and balsamic atmosphere. Towards the end of the rainy reason the storms commence in the afternoon, and heavy showers may fall continuously during two or three days. We would suppose that the small area of Honduras, which covers only three degrees of latitude, would have a nearly uniform season over the entire territory, which is not at all the case. The rainy season gradually advances from the Pacific coast towards the interior, and from there to the north coast. It thus happens that the Atlantic and Pacific coasts are polar, or opposite, in regard to their seasons. In January the dry season is prevailing on the Pacific coast, whilst there is a wet season on the Atlantic shores. In the interior of Honduras rains are less powerful, but they usually continue longer. On the Atlantic slope the rains are heavier than on the Pacific, which is, most likely, caused by the more vigorous growth of vegetation on the latter coast.

It is quite evident that a territory which originated chiefly through the aid of plutonic and volcanic agency is destined to be most diversified in regard to the diffusion of its valleys and mountains, and more so if we remember that the huge edifice, the Central American continent, is not the effect of *one* upheaval of firm land, or one sudden rise of fused mineral masses, but that this process was a gradual and periodical one, consisting of sudden eruptions, followed by long pauses of rest.

As these eruptions occurred at different times, it may follow that the direction of the eruptive mountain ranges was likewise divergent, which is actually the fact.

Over the whole territory of Honduras there are spread numerous systems of mountain ranges, which usually are called in that country "montanas," and montanitas if of a smaller size. On the western boundary of Honduras these ranges run *usually* from north to south; as, for example, the montanas de Monticillos and the montanas de

Yojoa, whilst on the western portion of this country the mountain-ranges extend nearly from east to west, as is the case with the montanas de Jutegalpa, and the montanas de Tonpocente.

We have thus in Honduras two main directions of mountain extent, —north to south, and east to west,—with a great series of other ranges, which intersect the above directions at various angles.

The zone of extension of these ranges is usually not in form of straight lines, but bent or curved, passing even into a circle, in which case the whole range, with its enclosed surface or valley, assumes a huge crater-form. A similar effect is sometimes obtained by the accumulation of mountain or mineral masses of a different lithological character in a peripheric zone, around an undisturbed centre.

Most of the ranges which present this curved zone of accumulation are but sections of large circles, or waves of undulation, in the center or height of which the protrusion of fused masses occurred.

The topographical structure of Honduras, with its diffused arrangements of mountain ranges of different eruption centers, is therefore most favorable for a display of numerous valleys, which are formed at the expense of large plateaux.

In regard to the shape and origin of the valleys of Honduras, we may make the following classification. Valleys are formed:

1. By the folding up of upheaved, undulating mountain masses.

2. By the accumulation of eruptive masses around an undisturbed center.

3. By the erosive action of water.

The first class of valleys is not often found in Honduras; they principally occur toward the Atlantic or plutonic coast.

The second class is of most frequent occurrence, usually of volcanic origin. Their manner of formation has been already explained by the deposit of fused mineral masses, around a centre which is the actual base of the valley.

The common form of valleys of this class is a round or elongated one, but various other shapes occur, as, for example, oblong ones, as the result of the intersection of two parallel mountain ranges. In fact, it would be impossible for me here to describe the diversified aspects of this class of valleys, originated as already explained, but subjected to manifold alterations by previously-existing objects.

I proceed to another group of numerous valleys, which I may call crater-valleys, as they are nothing but craters or vents of volcanic ranges now inactive. Their ordinary form is circular, and the base of the valleys is from two to ten miles in diameter. Usually they occur

in series of from two to six valleys, arranged in a linear direction, and only separated from each other by narrow mountain-ridges, at an elevation above sea level of from six hundred to twelve hundred feet. Such a linear arrangement of crater-valleys we encounter on the volcanic side of Honduras, the Pacific coast, in the neighborhood of the village of Langli.

Before reaching the village we arrive at the foot of the volcanic range, the top of which is provided with a series of craters, formerly the theatre of fiery eruptions, now partly covered with vegetation and inhabited by man.

We ascend the ridge of the mountain range and arrive at its top, when we descend its steep slope, traverse the plain of the valley, and ascending again we find on the top, below us, an exact similar valley as that of Langli, and so on until we have traversed the whole range.

This form of ranges, with their tops provided with a series of funnels or craters, has great resemblance to those which I have previously described as presenting a series of peaks or cones on their summits arranged in a linear succession. In fact, we may call it the same, with the only difference that in the first-mentioned case the figure of the peak or cone is most prominent, whilst in the second case (the valley arrangement) the form of the crater or funnel is more decidedly expressed by nature. These two mountain forms stand in the relation to each other as do the matrix and the mould.

Our third class of valleys—the *erosive valleys*—are, as their name expresses, caused by the erosive action of water, and are the products of the drainage of Honduras. They are of comparatively modern origin, and contain river beds which during the rainy season carry enormous masses of water, producing further erosion, and with it an extension of the valleys in regard to width and depth.

In order to obtain a complete survey of the various past epochs up to the present time let us once more return to the tertiary period.

The idyllic and picturesque valleys of the present Honduras were then for the greater part the theatre of volcanic activity. After a long elapse of time the fiery, eruptive zones cooled down, assisted in this process by water, which came in the form of rain or aqueous ebullitions from the craters. A great number of these craters became thus filled up with water, forming lakes. By aid of the drainage of the volcanic mountain slope, which enclosed, as previously mentioned, large tracts of land, thus forming valleys, the latter were transformed into basins, which became covered with water, thus passing into lakes of large dimensions.

The existence of a large *lake area* during the diluvial period, which I found to have extended nearly over the whole territory of Honduras, is not merely based upon the theory of a necessary accumulation of water in natural basins, on account of the absence of erosive valleys or river systems, but it is founded upon the existence of well-preserved shore-marks and shore-lines of these former lakes.

The lines of the erosive action upon the mountains surrounding our present valleys extend in a *horizontal* direction, dividing the slope of the mountains into two zones, one acted upon by water, the other by air and vegetation, but destitute of these marks. The lines of demarkation between the sea level and the shores are as well preserved and marked as if the lakes were still in existence.

These lines of erosion are *horizontal*, and not *inclined* as those produced by river erosion, and are therefore a strong evidence of the existence of accumulated water or lakes in those valleys bearing those shore-marks.

Descending from the height of the lake shores to the base of the valley, we find in sinking a shaft stratified formations of soil, sand, and clay, containing animal remains. At the present time these lakes have disappeared, but we have one illustrating example left in the form of the lake of Yojoa. This system of former lakes stretched across Honduras. I may mention, as former lake-beds, the valleys of Tegucigalpa, Comayagua, Danli, Portrerius, Santa Barbara, and a great portion of the province of Olancho.

There is an old Indian legend extant among some Indian tribes of Central America which tells us of an underground passage connecting the Atlantic and Pacific oceans, in the form of a natural canal, used by their ancestors for navigation. Might this tradition not have reference to an overground passage through those lakes existing in former or ancient times, perhaps even in the early era of man? The topographical arrangement of the present valleys, formerly craters, passing into reservoirs of lakes, would form a great deal of probability for our supposition, and more so as a similar passage is proposed in the Nicaraguan canal project, which would utilize the existence of the two large lakes, Managua and Nicaragua, which unite, by aid of the river San Juan, with the Atlantic.

The large amount of water spread in ancient times over Honduras must have caused heavy rainfalls, a vigorous growth of vegetation, frequent earthquakes and new eruptions of volcanic material.

These results combined contributed to the wear of the banks of those lakes, and the enclosed water masses found their way to the sea,

forming large erosive valleys with river systems connecting the interior directly with the briny waves of the oceans. By aid of this new system of draining the territory a considerable number of lakes lost their former supply of water. Gradually they began to evaporate, lowering constantly their shore-marks, till they were reduced to swamps, and from this passed into the present fertile valleys which we find so frequently in Honduras.

During my exploration in Honduras I never observed glacial marks. The absence of these self-registered graphical records of moving ice masses, would imply either that the glacial period did not exist as such in Honduras, or that the marks or engravings of that period may have been destroyed by the action of water and vegetation. The latter case seems very probable, but the absence of real glacial *moraines* in this country is a strong indication of the non-existence of the glacial period.

The luxuriant forests which, without doubt, have surrounded those *ancient* lakes were inhabited and visited by gigantic mastodons and alligators, numerous remains of which we frequently find in a state of good preservation from ten to fifty feet below the alluvial grounds of former swamps or lakes. As mastodon localities I mention the valleys of Danli, Portrerius, Santa Gracias, Santa Rosa, Santa Barbara, and Olancho. Inasmuch as we find nearly whole skeletons of mastodons in certain places, we may conclude that these animals existed in close neighborhood to their present burial-places, and were not carried from afar by streams or rivers. The mastodon remains are in size and form nearly corresponding to the New York mastodon, with the exception that the tusks of the Hondurian mastodon are less curved, and are therefore nearly straight. With the lakes disappeared also the gigantic mastodon, but of their associates, the tapir and the wild boar have been left behind in present Honduras.

A new scene—a psychozoic one—is going to unroll itself before our eyes. The swamps have partly passed into fertile grounds, covered with valuable woods, inhabited by animals, which provide an abundant supply of food for man, and richly impregnated with mineral substances, which were ejected from the interior of the earth through large fissures in which they deposited, forming mineral accumulations of considerable value.

Such was the country given by nature to daring man! He soon appears before us, not as an uncivilized giant or savage, but as a man accustomed to comfort and experienced in art and music. In Honduras no *woeful remains* of giants are found, and most likely never will be discovered; but we find, nevertheless, abundantly, genuine remains,

in form of temple and sacrificial mounds, containing vases, idols, ornaments, and arms.

From the character of the painting on a large vase, in excellent preservation, excavated at Oropoli, in Honduras, we feel strongly inclined to attribute the vase to a nation who came in contact with Israelites, Persians, or Egyptians. The face of the main figure is of Hebrew cast; the costume is Asiatic; Persian hat, with Egyptian veil or head-dress, and long narrow boots; seated on a high Egyptian throne, holding two clarionets in the hand. The scene represented is that of snake-charming, which art is usually found with Asiatic people. If we remember that the Phœnicians, whose history is yet half concealed in the dim twilight of human records, penetrated far out on the Pacific ocean, we must not wonder if future archæological discoveries in Mexico and Central America should prove a close relation between the Aztecs, or the first settlers in Honduras, with an Asiatic people who might have reached the shores of the New World by aid of navigation.

With these archæological remains, which indicate a high grade of civilization on the part of their manufacturers, we find sometimes crude implements, as arrowheads, hatchets made of greenstone, idols of clay and jade. The idols of this race are also of an Asiatic character. There are yet direct descendants of this race living in Honduras, usually called Indians, but their whole appearance, their plays and traditions, are Asiatic. How did this race reach Central America? is what we ask. Most likely by emigration from Asia *via* Behring Strait to North America, and from there to Central America, in a similar manner as the mastodon extended its migrations from the southern part of Europe, Asia, and North America down to Central America.

The Asiatic or Mongolic tribes, as, for example, the Alans and Huns, at an early period of our history undertook large migrations, conquering a large portion of Europe. Should not similar large Asiatic migrations have extended towards the northern part of Asia, driving its inhabitants over the Behring Strait to the American continent?

The American continent, probably once known to some Asiatic people, became forgotten.

On the 14th of August, 1502, the precise records of history mention the American continent in their annals. On that date Christopher Columbus appeared before the Cape Casinas on Honduras territory, and entered for the first time the American continent as the first stranger who rediscovered America in our historical time.

We know enough of the cruel Spanish systems of oppression and barbarities. The Spaniards were compelled on the 15th of September, 1821, after some struggle with the natives of Central America, to resign their assumed rights over that country and its people.

Central America divided itself politically into the republics of Honduras, Guatemala, Salvador, Nicaragua, and Costa Rica, all of which abolished slavery as one of their first acts. Honduras, a constitutional republic, is at the present time in a very prosperous condition. Its doors are opened for commerce, and its coasts and interior offer ample rewards for the industrial enterprises of man. The wheel of time, producing changes, is never at rest. M. J. R. FRITZGAERTNER.

GEOLOGY AND PALEONTOLOGY.

On a New Dog from the Loup Fork Miocene.—AELURODON COMPRESSUS sp. nov. Represented in my collection by a single mandibular ramus of the left side, and by two rami in the collection of the Museum of Comparative Zoology of Cambridge. The latter have been referred by Professors Scott and Osborn to the *Ae. hyaenoides* Cope (Bulletin Mus. Compar. Zoology, 1890, December), but I find on direct comparison with the type that the species is different. When the heel of the inferior sectorial is placed in position on the first tubercular superior molar of the *Ae. hyaenoides*, the second superior tubercular of the latter does not reach the second inferior tubercular of the *Ae. compressus;* and the posterior border of the superior canine marks the middle of the penultimate inferior premolar of the latter.

The canine in the *Ae. compressus* is rather small, while the sectorial and first tubercular are large. The fourth premolar is one-rooted, and the third has two distinct roots, and is nearly as large as the second. The crowns of these teeth are not preserved in the specimen. The first inferior premolar is not so robust as in the *Ae. sævus* Leidy and other species, but is more compressed. It has a strong posterior cutting lobe, and a low posterior basal cingulum. No anterior basal cusp or cingulum. The heel of the sectorial is as wide as long, and is half as long as the blade. The anterior border of the latter overlaps a little the heel of the first premolar on its inner side. The borders of the heel are of equal elevation. Roots of first tubercular divergent. Root of second tubercular compressed and situated on the oblique base of the coronoid process. The ramus mandibuli is rather shallow

and robust. Its inferior border is nearly straight to below the second root of the first tubercular. It is there strongly curved upwards, in a regular convex outline. There are two mental foramina, one below the second, the other below the third premolars. The alveolus of the external incisor is large, and is directly in front of the canine. The symphysis extends posteriorly to the middle of the pm. iii.

Measurements.—Length of dental series, inclusive of canine (in a straight line), 73 mm.; of premolar series, 30 mm.; of sectorial, 19 mm.; of base of $\overline{m^{2}}$, 10 mm.; of alveolus of $\overline{m^{3}}$, 5.5 mm.; length of heel of sectorial, 6 mm.; width of do., 6 mm. Depth of ramus at pm. iv., 15 mm.; at front of $\overline{m^{2}}$, 18 mm.

From the Loup Fork Miocene of Nebraska.

In illustration of the general characters of the genus Aelurodon, I give a restoration of the skeleton of the *Ae. sævus* Leidy, from a mounted specimen in my collection. The shaded parts represent the bones in my possession.—E. D. Cope.

On Dendrophycus triassicus Newb.—In the last number of the Naturalist is a paper on "Variation," by Professor Joseph F. James. Much of the matter of that paper is interesting and valuable; but there is one paragraph, on page 1080, to which I decidedly object. It does injustice to me and discredit to the author. The passage is as follows:

"Even in one of the latest monographs published by the U. S. Geological Survey (Vol. XIV.) we observe an inorganic marking (as it appears to us) masquerading under the name of a sea-weed; and under a new name, too, because its brother rill-mark existed some geological ages prior to its own oncoming formations."

This paragraph must refer to my *Dendrophycus triassicus*, since there is no other sea-weed described in the volume, and I remark upon the resemblance which this bears to *Dendrophycus desorii* Lesq., from the Pottsville red shale (Lower Carboniferous).

Now, as Mr. James has probably never seen a specimen of the plant I described, and certainly has never seen the type specimens, he seems to me hardly qualified to express an opinion upon the subject. Besides that, there can be no question that *Dendrophycus triassicus* is a plant, and not a rill-mark. I have been for half a century studying rocks and fossils in the field, and have given special attention to fossil plants; hence I ought to be qualified to decide whether the impression in question is of mechanical or organic origin.

I am familiar with the discussion which has taken place between Dr. Nathorst and the Marquis de Saporta about fossil algæ, tracks, and

trail-marks, and I know how dogmatically Mr. James has written on the so-called sea-weeds of the Cincinnati group; and yet I can see no reason for doubting that Dendrophycus is organic, and no excuse for the confidence with which Mr. James pronounces an opinion upon a subject of which he really knows nothing. Nobody doubts the organic character of Spirophyton; but no one can compare Dendrophycus with the various species of Spirophyton which occur in the Cauda-galli grit, and thence upward into the Coal Measures, without seeing that they must go together. Still further, no one can compare good specimens of Dendrophycus—those showing the extremities of the fronds—with sea-weeds of the genus Desmarestia without finding so much in common as to be convinced that they are nearly related. This similarity was remarked by Professor Balfour, to whom the plant of the Umbral shales was referred by Professor Rogers. We find in both the same cylindrical, firm, hard and smooth stems, dichotomously forked, becoming at their extremities wire-like, and terminating in slender, acute points. In Dendrophycus, as in Desmarestia, many of these terminal branches are set with lateral, acute, alternate thorns. Any one who will examine *the specimen*, part of which is figured in Monograph XIV., U. S. Geological Survey, Pl. XXI., Fig. 2, will, I think, regard the theory that it is a rill-mark as untenable. To all those who have been led to such a conjecture by the imperfection of the figures given, or the positive tone of Mr. James's paragraph, I can only say, examine the specimens and that idea will be no longer entertained.

In order to get all the light possible on this subject, I sent some specimens of Dendrophycus and Spirophyton to Professor W. G. Farlow, of Cambridge, our highest authority in all that pertains to the algæ; he kindly gave me the result of his examination of these specimens in a letter of considerable length, in which he expresses the opinion that they are organic and not of mechanical origin, and that they are the remains of sea-weeds. Had Mr. James waited until he could have seen the specimens of Dendrophycus, I venture to say he would never have given expression to the dogmatic and even contemptuous opinion which is contained in the paragraph I have quoted.

J. S. NEWBERRY.

New York, Nov. 7th, 1890.

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—A most important contribution to the study of the origin of the crystalline schists has lately been made by Van Hise,[2] through the medium of the Bulletin of the recently organized Geological Society of America. It will be remembered that only a short time ago this writer[3] showed that certain mica-schists of the Penokee-Gogebic region in Wisconsin and Michigan are nothing less than sediments, in which secondary mineral changes have taken place. He now goes further, and shows that under the influence of pressure, and probably heat, the pre-Cambrian slates and conglomerates of the Black Hills, Dakota, have been changed into schistose rocks, among which are gneisses. The reasons given for this conclusion are: (1) The gradation of the slates into schists, with loss of slaty cleavage, and the development of a foliation, usually oblique to the cleavage, and sometimes even perpendicular to it; (2) the concentric arrangement of the schists around granitic areas in such a way that the strike of their foliation is always parallel to the boundaries of the eruptive rock, and the dip always inclined away from them; (3) the clear evidence afforded by the microscope to the effect that the rocks intermediate between the schists and slates have all suffered squeezing to such an extent that their various constituents, more particularly the quartz, have been flattened, cracked, and even broken, so that their different parts extinguish differently; and finally (4) the certainty that much of the material of the schists is of secondary origin. The new minerals produced by the forces at work are silica in different forms, biotite, muscovite, and feldspar, and sometimes hornblende, garnet, tourmaline, and staurolite. In the less schistose varieties the grains of the original slates can be distinguished, as they are outlined by a layer of ferrite deposited upon them before they had lost their characteristic shapes. The quartz grains are flattened in the direction of the line of supposed pressure, and are broken. The cracks are often filled with particles of iron oxides, and sometimes are marked by lines of fluid inclusions. The deposition of silica around the fractured quartz grains and the production of secondary mica and feldspar are regarded as abundantly able to change a slate into a schist, especially when foliation has been

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] Bull. Geol. Soc. of Am., Vol. I., p. 203.

[3] AMERICAN NATURALIST, Aug. 1886, p. 723.

superinduced by pressure, with the aid of heat sufficient for the fusion of the original sediments. Attention is called to the fact that these schists are not members of the great complex underlying the earliest sedimentary rocks, but are contemporaneous with some of the latter which are probably of Huronian age.——After a very thorough discussion of fifty-three analyses of plutonic and effusive rocks Rosenbusch[4] concludes that the cause of the great variety in the rocks extruded from an eruptive center is the capacity of an original magma for separating into portions with different compositions (Spaltungsfähigkeit). These different portions may exist under the earth's crust in positions very near each other. From the very nature of the discussion, depending as it does upon so much detail, it is impossible to reproduce its argument in these pages. It must satisfy our present purposes to state that Prof. Rosenbusch thinks the original magma had a composition near that of a mixture of elæolite-syenite, peridotite and residues of the formulas $(NaK)AlSi_2$ and R_2Si. The residue $(NaK)AlSi_2$ possesses the capacity of taking up silica and yielding granite magma. The first splitting of the original magma yielded derivative magmas (theilmagmen), which have solidified as plutonic rocks. Further differentiation produced the materials whose solidification yielded the effusive rocks. This explanation of the differences existing in the composition of the plutonic rocks and their corresponding effusives is thought by Rosenbusch to be better than that which ascribes them to a separation of the original magma according to the density of its parts, whereby the highest portions (those producing the effusive rocks) had of necessity a different composition from the lower portions. The paper contains significant utterances with respect to the relations between the geological age of a rock and its structure. It is said that the difference between older and younger effusive rocks is "that the former have existed on the surface for a longer time than the latter, and consequently have suffered a series of changes (umbildenden Processen) . . . One needs no great gift of penetration to prophesy that in the near future this separation [of the paleovolcanic from the neovolcanic rocks] will lack recognition."——Dahms[5] has examined a set of hand-specimens brought from the Transvaal, Africa, among which he recognizes gabros containing pleochroic diallage and augite, the two minerals occurring in different parts of the same mass, and secondary quartz and hornblende. He finds also diabases and quartz-diabases, a quartz-porphyry in whose quartz-phenocrysts are inclusions

[4] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 144.

[5] *Neues Jahrb. f. Min.*, etc., Beil. Bd., VII., 1890, p. 90.

of carbon-dioxide, augite-porphyrite, granite, and granitic and syenitic porphyries. Each of these rocks is described, and analyses of several of them and their constituents are given. The most interesting point brought out by the analyses has reference to the relation between the diallage of a gabbro and the secondary hornblende derived from it.

	SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na_2O	K_2O	H_2O
Diall.	53.53	3.12	5.09	13.54	6.19	18.77	.57	.20	
Hornb.	52.73	4.70	5.26	10.21	12.58	12.59	.23	.06	1.54

An increase in CaO and decrease in MgO in passing from diallage to hornblende is in opposition to the view held in regard to the nature of the change. The author is compelled to look upon it as paramorphic. ——Cathrein[6] has re-examined the rock from Ehrwald in the Tyrol, called by Pichler augite-porphyry, and thought by Rosenbusch to belong possibly with the teschnites, and has found it to consist of phenocrysts of augite, both monoclinic and orthorhombic, in a ground-mass composed of crystals of biotite, pyroxene, hornblende, apatite, and magnetite, in a base containing some radially fibrous mineral in an isotropic substance. The rhombic-pyroxene has been changed to bastite, which is intergrown with biotite and augite, and is surrounded by small crystals of augite of the second generation, of hornblende, and of biotite. The augite of the ground-mass is grouped in aggregates resembling chondrites, and is pleochroic in violet and yellowish-red tints. The author classes the rock with the augitites, and calls it bastite-augitite or Ehrwaldite.——Spherulites composed of radiating bundles of an alkaline feldspar and spherical masses of tridymite occur in the obsidian of the Lipari Islands, according to Mr. Iddings.[7] They are similar to the spherulites and lithophysæ of the rock from Obsidian Cliff, and contain, like the latter, little honey-yellow crystals of fayalite.——In an appendix to an article by Mr. Barlow[8] on the contact of the Huronian and Laurentian rocks north of Lake Huron, Dr. Lawson briefly describes a few sections of quartzites on the contact with gneisses, in the former of which he believes are evidences of contact alteration, in which event the gneisses must be regarded as eruptive.——Mr. Fairbanks[9] has examined eighty sections of basic dykes from the north shore of Lake Huron, and has found them to be diabases, diorites, and alteration products of these.

[6] *Verh. d. k. k. geol. Reichsanst*, I., 1890, p. 1.

[7] Iddings and Penfield, *Amer. Jour. Sci.*, July, 1890, p. 75.

[8] *Am. Geologist*, July, 1890, p. 19.

[9] Ib., Sept., 1890, p. 162.

Mineralogical News.—In two very much decomposed rocks from Custer County, Colorado, Mr. Cross [10] has discovered an interesting series of secondary *hornblendes* and *pyroxenes*, whose study leads him to the view expressed by Williams, viz., that the most convenient way to place hornblende crystals in order to show their relations to pyroxene is with the orthodome in the position of the basal plane. One of the amphiboles described is a blue variety with the pleochroism of glaucophane. It is found in a rock composed of green pyroxene and small pieces of brown hornblende, imbedded in a matrix of quartz, calcite, and minute blue and green amphibole needles. It is an alteration product of the brown hornblende and the augite, from both of which it results either directly or through the interposition of actinolite. Both the latter mineral and the blue hornblende are also found as enlargements attached to the clinopinacoidal and terminal planes of the brown hornblende and the augite. The axis of greatest elasticity of the blue hornblende is inclined 13° to 15° to the vertical cleavage, and is on the same side of it as in the case of glaucophane, actinolite, etc., while in common hornblende it is on the opposite side, since the extinction angle is here the angle included between c and the axis of least elasticity. The optical angle of the blue amphibole is large, and the absorption is $A > B > C$. A second rock in which the mineral occurs is a conglomerate, in pebbles in which the same relations exist between the hornblendes as those mentioned. A second rare variety of amphibole discovered in these rocks is of a rich chestnut-brown color, and has an extinction of 8°. It is regarded as an added growth. An emerald-green secondary augite occurs in diorite pebbles in the conglomerate above mentioned. It is an alteration product of the blue hornblende and of an unknown yellow miner Its axis of greatest elasticity is but slightly inclined to c. Its pleochroism is strong in green and yellow tints, and its absorption as follows: $A > B > C$. Upon comparing the properties of these minerals with those of other members of the amphiboloid group Mr. Cross is inclined to regard the chestnut-brown hornblende as closely allied to *barkevicite*, while the blue variety is either *arfvedsonite* or *riebeckite*. The green augite is considered to be *ægerine* or *acmite*. Twelve diagrams exhibiting the relations of the axes of elasticity to the crystallographic axes of the different varieties of amphibole and pyroxene accompany the article. If the plane usually taken as the orthodome in hornblende and augite is made the basal plane, the relations shown by the diagrams are rendered quite simple; whereas if the usual

[10] *Amer. Jour. Sci.*, May, 1890, p. 359.

orientation is accepted the relations are not apparent. The paper is important as affording strong argument for a change in the position of crystals of hornblende and augite, as also for the interesting announcement of the discovery of a secondary augite.——The parting of certain hornblende crystals from St. Lawrence County, N. Y., analogous to the basal parting of augite, has been found by Williams[11] to be the result of twinning along gliding planes parallel to the face usually regarded as the orthodome. Since the parting in augite takes place parallel to the basal plane, and since in parallel growths of hornblende and augite the parting in the two minerals is parallel, it is suggested that in both cases the plane parallel to which the parting takes place be taken as oP. The advantages of this new position lie in the correspondence between the morphological and optical properties of the two minerals.——Crystals of beautiful blue *celestite* are described by Williams[12] from the Helderberg Limestone in the western flank of Knobly Mountain, Mineral County, West Virginia. They occur in flattened lenticular pockets, partially or entirely filled with clay. The crystals, which are associated with gypsum and calcite, are found implanted on the walls of the cavities or imbedded in the clay. The celestite is pyramidal in habit in consequence of the predominence of the brachypinacoid $\breve{P}4$. In some crystals these faces occur alone, when the crystals are often rounded into lenticular bodies. Other forms observed are $\infty\bar{P}\infty$, $\frac{1}{2}\bar{P}\infty$, oP, $\breve{P}\infty$, and ∞P. oP is rough and drusy, and $\infty\bar{P}\infty$ is vertically striated. The optical angle is $2V_{Na} = 49° 54'$, and composition almost pure $SrSO_4$. The resemblance in habit between these celestites and thinolite,[13] and their similarity with the Sangerhausen pseudomorphs that have generally been referred to gaylussite, are striking.——Becke[14] has examined some highly modified *dolomite* crystals from the Binnenthal and from Scaleglia, and *magnesite* from the latter locality, and on the former has found some new rhombohedra. The dolomite from Scaleglia is marked by unsymmetrical etched figures that differ in shape from those artificially produced on this mineral. The magnesite is interesting, as it contains two orders of scalenohedra, the first forms of this kind found on the mineral. The hemihedral crystallization of calcite, siderite, and magnesite, and the tetratohedrism of dolomite are explained in accordance with the Sohncke-Wulff theory, by the fact that the latter's molecule comprises

[11] *Am. Jour. Sci.*, May, 1890, p. 352.

[12] Ib., March, 1890, p. 183.

[13] Dana. Bull. U. S. Geol. Survey, No. 12, 1884.

[14] *Miner. u. Petrog. Mitth.*, XI., 1890, p. 223.

two metallic elements of different kinds, while in the former the metal is of but one kind. A full list of forms that have been discovered in dolomite is incorporated in the descriptive part of the paper.——Mr. Kemp[15] communicates a few notes on some peculiar *calcite* crystals, and also on tourmalines, sphenes, and magnetites that have been subjected to pressure. The magnetite is striated as a result of the pressure, which has produced a parting apparently parallel to O and ∞ O. The minerals were found in the vicinity of Port Henry and Mineville, N. Y. ——A new analysis of Cornwall *connellite* by Penfield[16] shows it to be analogous in composition to the new mineral spangolite. Its formula may be written $Cu_{15}(ClOH)_4SO_{16}+15H_2O$.——The hexagonal tables of *eisenglimmer* in the sunstone of Tvedestrand, and in the carnallite of Strassfurt are pleochroic, according to Rinne,[17] with $\omega > \varepsilon$. The colors are yellow and dark brown.——As the result of several analyses Jannettaz[18] concludes that oriental *turquoise* is colored by phosphate of copper, while the color of the occidental turquoise is of organic origin and due to phosphate of iron (vivianite).——The *titan-olivine* of Damour (from Pfunden, in the Tyrol), thought by Descloizeaux to be orthorhombic, has been examined optically by Lacroix,[19] and found to be monoclinic. Its thin section is pleochroic in yellowish and reddish-yellow tints. It is polysynthetically twinned, and its optical angle $2V=62° 18'$. It is, therefore, intermediate in character between olivine and the minerals of the humite group.——At the lower extremities of stalactites of *nesquehonite*[20] pseudomorphs after *lansfordite* from Lansford, Pa., Genth and Penfield[21] have discovered crystallographic planes which enable them to work out very satisfactorily the crystallization of the original mineral, which is found to be triclinic with $a:b:c=.5493:1:.5655$.——The similarity in properties between *agalite* from northern New York and bastite seems to indicate that the former mineral is an altered enstatite.[22]——Gürich[23] has recently published a list of the minerals occurring in the German possessions of Southwestern Africa. The list embraces about fifty-five species, and these are separated into groups, according as they occur

[15] *Amer. Jour. Sci.*, July, 1890, p. 62.

[16] Ib., July, 1890, p. 83.

[17] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 193.

[18] Bull. Soc. Fran. d. Min., 1890, p. 106.

[19] Ib., XIII., 1890, p. 15.

[20] AMERICAN NATURALIST, April, 1889, p. 261.

[21] *Am. Jour. Sci.*, Feb., 1890, p. 128.

[22] Scheibe. *Zeits. d. Deutsch. Geol. Ges.*, 1890, XLI., p. 564.

[23] *Neues Jahrb. f. Min.*, 1890, I., p. 103.

in pegmatite or in quartz veins, in quartz lenses in schists, or imbedded in granite, mica-schist, hornblende rocks, crystallized limestones, or garnetiferous beds.——Oebbecke [24] describes briefly a small crystal of *arsenopyrite* from the granular limestone of Wunsiedel, in the Fichtelgebirge. Its composition is: As = 46.91; S. = 18.64; Fe = 34.31. ——Mr. Diller [25] announces the discovery of native *gold* in calcite from near Minersville, Trinity Co., Cal., and Mr. Hersey [26] mentions the discovery of *arsenic* in nodular masses in a silver and gold mine a few miles west of Leadville, Colorado.——*Magnetite* crystals from serpentine in New Zealand are reported by Prof. Chester [27] to have the composition following:

Fe_2O_3	FeO	Mn_3O_4	MgO	CaO	SiO_2
66.71	19.62	4.63	7.15	tr.	2.38

The silica is supposed to come from particles of silica adhering to the crystals.——Lacroix [28] believes that *carphosiderite* is a much more common mineral than is generally supposed.

Mineral Syntheses.—By an interesting series of experiments, that are in the main but modifications of well-known processes, Weinschenck [29] has prepared metallic sulphides with many of the properties of the natural compounds. By distillation of the oxides with salammoniac and sulphur he obtained crystals of pyrite and of a regular copper sulphide with the composition of chalcocite. By the action of sulphuretted hydrogen under pressure upon the proper salts, galena, argentite, covellite, cinnabar, orpiment, troilite, millerite, and alabandite were produced. Corundum, diaspore, and rhodochrosite were obtained by the action of urea upon suitable compounds in solution. Other experiments afford an insight into the method of formation of the minerals of the apatite group. The paper is a valuable contribution to the study of the genesis of some of the most important of the common minerals.——Messrs. Hautefeuille and Perry [30] have dissolved alumina in nepheline, and have gotten a vitreous paste in which are many hexagonal plates of corundum.——Michel [31] has produced

[24] *Zeits. f. Kryst.*, etc., XVII., 1890, p. 384.

[25] *Am. Jour. Sci.*, Feb., 1890, p. 160.

[26] Ib., p. 161.

[27] *Min. Mag.*, 1889, VIII., p. 125.

[28] Bull. Soc. Franc. d. Min., Jan., 1890, p. 8.

[29] *Zeits. f. Kryst.*, XVII., 1890, p. 486.

[30] Bull. Soc. Franc. d. Min., 1890, XIII., p. 147.

[31] Ib., p. 139.

azurite and gerhardite by allowing a solution of nitrate of copper to act on particles of calcite several years under the ordinary pressure. ——Nepheline, leucite and orthoclase have been obtained by Messrs. C. and G. Friedel[32] upon treating finely-powdered muscovite with alkalies and alkaline silicates in various proportions. With potash containing about two per cent. of soda a portion of the muscovite is dissolved, and prismatic hexagonal crystals of nepheline are yielded. The composition of these shows them to consist of a mixtnre of one part of potash nepheline to two parts of the corresponding sodium compound. When soda is substituted for potash the nepheline crystals produced measure 5—8 mm. in length, and consist of one part potash nepheline to three parts of the sodium compound. When treated with silicate of potash and heated, beautiful crystals of orthoclase are produced. Leucite, together with orthoclase and nepheline, are yielded by a mixture of mica with half its weight of calcined silica and seven-tenths of its weight of potash. The same experimenters[33] produced anorthite by treating mica at 500° with lime in the presence of water. Having obtained sodalite[34] by the action of soda and sodium chloride in mica, they next attempted to make nosean by substituting the sulphate for the chloride in the last experiment, but succeeded[35] only in the production of prismatic negatively uniaxial crystals differing from nosean in containing two molecules of water.——Nitrate of copper heated to 130° in sealed tubes with urea yields[36] a basic nitrate identical with gerhardite.[37]

[32] Ib., p. 129.
[33] Ib., XIII., p. 233.
[34] Ib., XIII., p. 183.
[35] Ib., XIII., p. 238.
[36] Mallard. Ib., p. 67. Cf. Ref. to Michel's Syntheses above.
[37] Wells and Penfield. *Amer. Jour. Sci.*, 1885, XXX., p. 50.

BOTANY.

Notes on Rare East Tennessee Lichens.—Two months of constant work, for which previous experience in Florida had prepared me, have been well rewarded by the securing of two hundred species, many, of course, common. Tennessee has ever been a paradise for the phanerogamic botanist, and justly so; but I venture to affirm that but few have delved very deeply for our humble lichens. And yet the inherent interest attaching to these plants is vastly enhanced by the inspiring associations of locality. Mountain-tops and their craggy sides, rent in places by deep cañons with towering walls on either side, two thousand feet in height, showing different geological strata, and affording a foothold for the holly, birch, and hemlock, present peculiar charms as well as advantages,—for each different stratum or tree may be the favorite substrate required to promote the growth of certain species. I find this fastidiousness as true of lichens as of their more pretentious and showy neighbors in the floral world. Economy of space will confine my notes now to some of those species that are practically rare or unknown in American Herbaria.

Ramalina calicaris, var. *farinacea* Schaer; somewhat abundant on sandstone on Lookout Mountain.

Theloschistes concolor Dicks; on oak and hickory trees; common.

Parmelia ambigua Ach.; on *Pinus mitis*. I omit a dozen other fine species, of which *P. borreri* is best developed.

Physcia ciliaris, var. *crinalis* Schaer; on oaks and Nyssa up to two thousand feet elevation; very fine.

Physcia aquila, var. *detonsa* Tuckerm.; abundant on Quercus on Lookout Mountain, and also on sandstones.

Pyxine sorediata Fr.; very finely fruited; abundant on sandstones, occasional on oaks.

Umbilicaria pennsylvanica Hoffm.; on sandstones; common; most developed at high elevation.

Sticta pulmonaria L.; found only twice,—on oaks along the mountains.

Peltigera canina; abundant in damp, shaded gorges.

Leptogium juniperinum Tuckerm.; exists in rosulate clusters on rocks and on cedar; a subspecies of *L. tremelloides;* Lookout Mountain.

Lecanora affords interesting forms. Among them, *L. cinerea*, *L. badia*, *L. tartarea*, a very elegant species with immense apothecia, in

appearance reminding me of *L. pallescens;* the ever-varying *L. cervina* Nyl.; subspecies *L. privigna*—var., is abundant, and of large size, with remarkable spores; on sandstone; I omit several other species.

Cladonia; of the numerous species I will only cite *C. cæspiticia* Flotow, and *C. turgida* Hoffm., which grow on bare rocks and earth at some elevation.

Passing by Bæomyces I find in Biatora a multitude of species, and mostly on rocks; as *B. rubella* Rabh., in several subspecies; *B. coarctata* Th. Fr., and var.; on trees are *B. russula* Mont., and *B. parvifolia* Pers.

Lecidea enteroleuca Fr., *L. platycarpa* Ach., *L. albocærulescens* Fr., occur on sandstones and chert in puzzling forms; *Buellia* affords interesting species, largely saxicolous; among the latter are *B. colludens* Nyl., *B. petræa,* and var. *albinea, B. spuria* Arn.; while the parasitic *B. inquilina* and *B. parmeliarum* occur on the thallus of other species.

Lecanactis premnea; on bark.

Platygrapha periclea Tuckerm.; found only on hemlock in mountain gorges, but associated with it are *Pyrenula thelæna,* and a very interesting Biatora near *effusa.*

Sagedia cestrensis and *S. oxyspora* on Ostrya and Betula.

Verrucaria pyrenophora is abundant on limestone.

These are only a few species identified from a practically unexplored mass of material. My thanks are due to my friend, S. Higginson, Esq., for assistance, while my Rabenhorst and Lojka specimens have enabled me to make good comparisons, especially in rock forms.—W. W. Calkins, *Chicago.*

Botany in the British Museum.—The recent report of the Curator of Botany in the British Museum contains a number of interesting matters. It appears that during the year 51,652 specimens were "mounted, named, and inserted in their places in the herbarium." These accessions came from many parts of the world,—Europe, China, Japan, Borneo, Africa, Australia, Canada, Mexico, and South America. It is consoling to American botanists to read that "the exhibited series of British plants has been completed as far as the vascular plants are concerned, every species recognized by Bentham in his 'British Flora,' being placed in the case, with its description from that work." If the complete exhibition of the British flora has just been achieved in so richly endowed an institution, we need not consider ourselves unduly delinquent in this country, where the local floras are so poorly represented in herbaria.

A thorough revision and rearrangement of the natural orders has made some progress, already including the Gramineæ, Compositæ, Caryophyllaceæ, Cupuliferæ, Filices, and several others. During the year the collection of microscopic preparations, numbering 4,429 specimens, made by Professor DeBary, was acquired by purchase. Many valuable collections of varying sizes were presented, and as many more were purchased.—CHARLES E. BESSEY.

The Word "Herbarium."—A writer in the *Pharmaceutical Journal*, Mr. G. C. Druce (quoted in the September *Journal of Botany*), says: "The origin of the word herbarium, as applied to a dried collection, is by no means certain. It is true we frequently meet with the name in the older writers, but to them it meant a book about plants, and generally an illustrated book." He then, after a general discussion, describes an old parcel of plants at Oxford which he examined recently. The specimens were in a good state of preservation, and proved to have been prepared by one Gregory of Reggio in the year 1606. This collection was labeled on the back "Herbarum Diversarum Naturalium." This the writer thinks is the earliest use of the word in this sense. Gregory of Reggio "was noted for his botanical knowledge."

The Microspores of Sphagnum.—In a preliminary communication in a recent number of the *Botanisches Centralblatt*, S. Nawaschin, of Moscow, attempts to answer the question as to the nature of the so-called "microspores" of Sphagnum. Having good material of *S. squarrosum* in various stages of development, he found that the microspores appear to develop from fungus-hyphæ, instead of from the well-known spore-mother-cells of the Bryophyta. Fungus-hyphæ were found in other portions of the Sphagnum plant-body, also adding to the probability of the fungus nature of the microspores. The investigator ventures the surmise that these puzzling spores are not Sphagnum spores at all, but those of Ustilagineæ, of the genus Tilletia. To it he gives the provisional name of *T. sphagni*.

The Species of Cotton.—Schumann, in his elaboration of the Malvaceæ for Engler and Prantl's "Natürlichen Pflanzenfamilien," recognizes three species of Gossypium (cotton), viz.:

G. barbadense L., with the "cotton" easily separated from the seeds, which are then naked.

G. arboreum L., "cotton" separated with difficulty, seeds with a persistent coat of short filaments, leaf-points oblong, flower purple-red.

G. herbaceum L., with "cotton" and seeds as in the last, leaf-points broad-ovate, flower yellow.

The first is a native of America, and is known as "sea-island cotton," "Barbadoes cotton," or "New Orleans cotton." The cotton of Peru is considered to be a variety of this species.

The second species has long been grown in Egypt, Arabia, and India, and produces an especially white cotton.

The third species is the one now so extensively grown in the Southern States, to which it was introduced from India a little more than a hundred years ago. During its long cultivation (more than 2600 years) it has given rise to a number of marked varieties, of which var. *religiosum* L., with yellow cotton, is known as "Nankeen cotton."

Fertilization of the Grape.—Dr. M. Kronfeld states that although the cultivated grape-vine is usually anemophilous, yet that, under certain conditions, it is fertilized by honey bees, especially when there is in the same neighborhood an abundance of other plants which are visited by bees (*Jour. Roy. Micros. Socy.* for August).

Another "Ism" in Botany.—A new word has been invented by Dr. Clos, to be applied to the dwarf-condition of plants. He calls it "nanism."

The Annals of Botany.—Number 13 of this excellent botanical periodical contains the following papers:

A monograph of the British Gastromycetes, by George Massee.

On a change of flowers to tubers in *Nymphæa lotus* var. *monstrosa*, by C. A. Barber.

On the change of shape exhibited by turgescent pith in water, by Anna Bateson.

Observations on the structure of the nuclei in *Peronospora parasitica* during the formation of the oospore, by Harold W. T. Wager.

On some recent progress in our knowledge of the anatomy of plants, by D. H. Scott.

The "Notes" are: A new application of photography to the demonstration of certain physiological processes in plants; double-flowered Ceanothus; on Dr. Macfarlane's observations on pitchered insectivorous plants; attempts to induce aposporous developments in ferns; a lily disease in Bermuda; the onion disease in Bermuda; a hybrid desmid; Vaucheria-galls; the stomata in the fruit of *Iris pseudacorus* Linn.; *Mystropetalon thomii* Harv.

In number 14 the leading papers are the following:

Monograph of the Lemnaceæ of the United States, by George F. Atkinson.

The mucilage- and other glands of Plumbagineæ, by John Wilson.

Note on the fertilization of Musa, *Strelitzia reginæ*, and *Ravenala madagascariensis*, by G. F. Scott-Elliot.

Ornithophilous flowers in South Africa, by G. F. Scott-Elliot.

Notes on *Chondrioderma difforme*, and other Mycetozoa, by Arthur Lister.

The "Notes" are: On cortical fibro-vascular bundles in some species of Lecythideæ and Barringtonieæ; Vaucheria-galls.

A New Work on "Plant Morphology."—Plant morphology has not in general been of such a nature as to commend it to the more critical of our scientific men. It has been too largely a merely technical discussion of those external structures which can be made use of in classification. So great has been the abuse of the term that many of the botanists of the new school refrain from using it lest they be misunderstood. What the study of the skins in the old-fashioned museums was to zoology, that the so-called "morphology" of the common botanical books has too largely been. The student of animals has long since discarded such a profitless labor, and has substituted the careful study of structural homologies based upon similarity of development. Animal morphology to-day occupies the greater part of the attention of zoologists, while comparatively little time is given to the study of purely external and superficial characters. In this way zoology has become much more philosophical than its sister science, botany.

A new work on the general morphology of plants ("Allgemeine Morphologie der Pflanzen"), by Dr. Ferdinand Pax, is written upon a somewhat higher plane than most of its predecessors, and will doubtless prove a good example to our text-book makers. It is divided into two principal parts, the one treating of the Morphology of the Vegetative Organs, and the other of the Morphology of the Reproductive Organs. The vegetative organs are included under "root" and "shoot," each of which is then discussed under several heads. The shoot is treated as follows: (I.) The structure of shoots and the shoot-system; (II.) biology of shoots; (III.) plasticity of shoots; (IV.) the life-history of the shoot; (V.) leaf-sequence in the shoot; (VI.) the leaf. The root is treated similarly, but at less length. In the treatment of the second part of the work, that relating to the reproductive

organs, there is less departure from the ordinary methods. There is a discussion, much after the usual fashion, of the "morphology" of the flower-cluster, and the flower, and in this the student will receive few if any new ideas. In the discussion of reproduction proper there is again much more that is modern and instructive. Thus we have:

(I.)—Non-sexual reproduction.
(II.)—Sexual reproduction.
  1.—Sexual reproduction of the Cryptogams.
  2.—Sexual reproduction of the Phanerogams.
  3.—Relation of sexual to non-sexual reproduction.

An interesting section is devoted to the phylogenetic development of the flower. The "flower" is very properly regarded as an evolution from modifications of the plant-body found in the Pteridophytes. The spore-bearing cone of Selaginella is "the prototype of an hermaphrodite naked flower," between which there is often a marked external resemblance.—CHARLES E. BESSEY.

ZOOLOGY.

A New Phoronis.—Dr. E. B. Andrews has found a new species of the remarkable genus Phoronis at Beaufort, N. C. It lives in isolated chitin-like tubes placed upright in the sand. The species has the greatest affinity with *Ph. kowalevskii* in the arrangement of its sixty tentacles, but it is remarkable for the presence of spoon-shaped glandular organs at either end of the lophophore. The function of these organs is unknown, but it is suggested that they may have some connection with the tube-building habit. The alimentary canal consists of two stomachs and an intestine. In the first stomach there is a longitudinal ridge of ciliated gland-cells, recalling that of Sipunculus. There is also a peculiar intracellular digestion in the first stomach. Apparently the sexes are separate. The left nerve-rod only has an extensive development. Dr. Andrews thinks that this species, which he has named *Ph. architecta*,[1] approaches nearer to the Sipunculid than to the Polyzoan type.

[1] *Ann. and Mag. Nat. Hist.*, June, 1890.

The Arthropod Eye.—Dr. Patten,[2] from a study of the eyes in several hexapods, concludes that "the convex eye of arthropods is a group of hair-bearing sense buds." New facts are presented regarding the eyes of Belostoma, Tabanus, and Vespa, and the following additional conclusions are drawn: The so-called pseudocone is the homologue of cuticular sense hairs; between the ommatidia occur hair-cells, which are surrounded by pigment, "so that they bore a very striking resemblance to ommatidia, and probably functioned as such." As a corollary the pseudocone type is the most primitive. Watase's view is regarded in this light as erroneous, the development of Vespa showing that there is no bending of the retinula cells. Patten thinks that a "telescoping" rather than an invagination must be invoked to explain the features of the arthropod eye. Corrections are made of former statements as to the relationships of the corneagen cells to the spindle (rhabdom), and the formation of the corneagen in Vespa.

Molluscan Notes.—Canon A. M. Norman, the English student of the invertebrata, has begun in the *Annals and Magazine of Natural History* a revision of the British mollusca.

It may interest conchologists to learn that the somewhat rare mollusc *Zirfæa crispata* occurs abundantly at Salem, Mass., at a spot where it is easily accessible at low tide. The locality is in a bed of indurated clay, about midway between the "neck" and the beacon on the neck bar. At low tide they are covered by but two or three inches of water.

The Origin of Vertebrates.—Two recent papers attempt to find the ancestors of the vertebrates in the arthropods. The first, by Dr. William Patten,[3] recognizes this ancestor in the arachnids. The nervous system is compared throughout with that of vertebrates, and some startling homologies are brought out, embracing not only general relationships but exact correspondences in minute details of sense organs, segments, nerves, etc. The vertebrate mouth arises as a modification of the dorsal organ, the notochord from the the mittelstrang of the arthropod nervous system, the cranium from the entosternite, the gill slits from nephridia; the pectoral fins are homologous with the scorpion pectines! Aside from these speculations the paper contains a number of observations on the embryology of scorpions and of Limulus.

[2] *Anat. Anzeiger*, V., p. 353, 1890.

[3] *Quar. Jour. Micros. Sci.*, XXXI., p. 317, 1890.

The second paper, by Dr. W. H. Gaskell,[4] is fairly appalling. In two former papers[5] we had been favored with a foretaste of this wonderful production, but here it appears in detail so far as the first chapter is concerned. Space will permit but a mere outline. Like Dr. Patten, he seeks the ancestor of the vertebrates in the arthropods, but there all unity ceases. The crustacean nervous system has grown around the alimentary canal, the latter producing the ventricles of the brain and the central canal of the spinal cord. The crustacean gill-bearing legs have been infolded, and give rise to the vertebrate gill-arches, while from the cavity thus formed the vertebrate alimentary canal has grown backward. The pituitary body is the green gland.

Amphioxus in Tampa Bay.—Since some recent attempts to obtain Amphioxus in Chesapeake Bay have been unsuccessful, and since there is considerable difficulty in securing it from other known stations, as Beaufort, N. C., the Bermudas, the West Indies, etc., it may be of interest to know that specimens were abundant and easily secured at Port Tampa, Fla., in March last. The "Port" is eight miles from the city of Tampa, and consists of a railroad trestle-work running out nearly a mile over the shallow water to the wharf where the Havana steamers land. Working from a boat, with only a dip-net, in water from four to six feet deep, some specimens could be obtained with every dip. They were upon the surface of the clean sand. The ground worked over was southward from the wharf, and extended about a mile along the margin of the ship-channel, which is marked by buoys. The location is so far from shore, and so far from disturbing agencies, that it might be expected to yield a constant supply. A light dredge, with fine-meshed bag, would be the most efficient collecting instrument. The specimens were from one to two inches in length.—ALBERT A. WRIGHT.

[4] *Quar. Jour. Micros. Sci.*, XXXI., p. 379, 1890.

[5] *Jour. Physiol.*, X.; *Brain*, XII., 1890.

PHYSIOLOGY.

Temperature in Nerves.—Rolleston,[1] by using an electrical resistance thermometer sufficiently delicate to appreciate one five-thousandth of a degree, finds, like other investigators, no evidence of the evolution of any heat from the nerve during the passage of a nervous impulse. In dying a nerve evolves heat, in some cases one-seventh of a degree C. The frog's sciatic was chiefly used.

Neurokeratin.—This substance, characterized by extreme insolubility, was discovered by Ewald and Kühne, in 1877, in medullated nerves and the central nerve substance. Kühne and Chittenden[2] have subjected it to a careful study. The nerve tissue was freed from the myelines by prolonged treatment with alcohol and ether; from all digestible matters by gastric and pancreatic juices; and from nuclein by extraction with alkali. Analyses of neurokeratin thus obtained from human brains gave C 56.11 to 58.45, H 7.26 to 8.02, N 11.46 to 14.32, S 1.63 to 2.24. Noticeable are the absence of P and the low amount of S. C is somewhat higher and N somewhat lower than in albuminous bodies. Ordinary keratin from rabbit's hair gave C 49.45, H 6.52, N 16.81, S 4.02, in which S is double its quantity in neurokeratin. The nerve cord of the lobster, treated in a similar manner, yielded a residue of chitin with no neurokeratin. Quantitative determinations in man gave for peripheral nerves .316 per cent., for cortex of cerebellum .312 per cent., for cortex of cerebrum .327 per cent., and for white substance of the corpus callosum 2.902 per cent. The results indicate for myeline-free, dry nerve substance, 1.91 per cent. of neurokeratin; do. gray substance, 3.22 per cent.; do. white substance, 33.77 per cent. Methods are given by the authors whereby this substance may be detected in nerve fibres.

Sensitiveness of Joints.—In studying the muscle sense Goldscheider hypothecates for the joints the two functions of mediating sensations of movement and sensations of resistance. For the former the sensitive substratum is to be found doubtless in the nerves and nerve endings of the capsule of the joint, these being stimulated by the working of the joint. For the latter the question arises whether in the hard surfaces the supposed sensitiveness really exists. He tests this[3]

[1] *Journal of Physiology*, Vol. XI., 1890, p. 208.

[2] *Zeitschrift f. Biologie*, Bd. XXVI.; also *N. Y. Medical Journal*, 1890.

[3] Verhandlungen d. Berl. Physiol. Gesellschaft; in Du Bois Reymond's Archiv, 1890, p. 380.

in the rabbit by touching, pressing upon, stroking, and heating points in the exposed articular surfaces of the tibia and metatarsus, and the deep-lying portions of the bones. Sensations indicated by respiratory reflexes were readily called out. The sensitiveness seems to lie not so much in the surface of the joint as in the layers beneath. No reaction was obtained from the hard bone itself, but the marrow was especially sensitive.

On the Self-Regulation of Respiration.—The effect of the stimulation of the central end of the vagus on respiration has been studied long and carefully, and with varying results. Meltzer finds [4] that weak and medium-strong currents have different effects in different individuals; while strong currents produce always the same effects, viz., inhibition of inspiration, followed soon by an inspiratory after-effect. There must then be fibres in the vagus that produce inhibition of inspiration. In some individuals medium and weak stimuli produce inspiratory effects; hence there must also be, in such individuals at least, fibres in the vagus that bring about inspiration. These may be likened to the accelerators of the heart, while the others act like the inhibitors of that organ. We may then conceive of the vagus as consisting of two kinds of fibres, one producing inspiration, the other inhibiting it. When the cardiac inhibitors and accelerators are stimulated together, the effect of the former alone is observed during stimulation; but after the latter has ceased the short after-effect of the inhibitor fibres is followed by the larger after-effect of the accelerator fibres. In like manner, as regards respiration, we may say that the nerve fibres that inhibit inspiration have but a brief after-effect, while those that cause it have a more prolonged influence. It has been shown that expansion by the lungs has the same effect on respiration as a strong stimulation of the vagus, producing first inhibitory and then inspiratory after-effects. Hering and Breuer formulated a now well-known theory of the self-regulation of respiration, the main principles of which are that expansion of the lung produces an inhibition of inspiration, while collapse produces a following inspiration. Meltzer claims that the latter part of this theory is not supported by facts, and substitutes a new theory based on the above conclusions, viz., the existence in the vagus of two kinds of fibres, namely, inspiratory and inspiration-inhibiting. "Inspiration expands the lung, thereby stimulating both the inspiratory and the inspiration-inhibiting nerve fibres. But during stimulation, and for a very short time after cessation of the expansion, the inhibiting

[4] *N. Y. Medical Journal*, Jan., 1890.

effects alone are manifested, thereby inspiration is interrupted, and an expiration, a collapse of the lungs, follows. But since, with the cessation of pulmonary expansion, the given stimulus disappears, and the after-effect of the inhibiting fibres is of but short duration, the latent inspiratory impulses prevail, owing to their long after-effect, and cause an inspiration. This again establishes an expansion of the lung, and thereby an expiration, etc."—L. G.

ENTOMOLOGY.[1]

An Outlet for Memoirs, Monographs, and Faunal Lists.[2]—As a rule the opportunities for publication of the experiment station entomologists are limited to station bulletins, and entomological or general natural history journals. The former, with rare exceptions, are only available for the publication of investigations having an immediate practical import, and the latter can only be satisfactorily used for articles of moderate length. It is true that to a certain extent monographs and revisions can be published in the Transactions of the American Entomological Society and the publications of the National Museum, but these channels are not open to all, and as a rule are reserved for monographic works relating to our fauna as a whole, rather than that of any particular locality.

If the biological work of the experiment stations is established on a broad and comprehensive basis many results will be obtained that are not of immediate interest to the farming community, and which could not be published, except in a fragmentary way, in the existing journals. Among such results the following general classes may be mentioned:

(1) Bibliographical matter, including bibliographies of the insects affecting certain plants, bibliographies of certain groups, faunal bibliographies, etc.

(2) Catalogues, descriptive and annotated, of the organisms of a locality, county, or state.

(3) Memoirs on the biology of certain groups, the insects relating to certain plants, or the relations of various organisms or groups of organisms to each other and to their environment.

[1] Edited by Dr. C. M. Weed, Experiment Station, Columbus, O.

[2] Prepared for Entomological Section, American Association of Agricultural Colleges and Experiment Stations, November, 1890.

(4) Monographic works.

It seems to me that there is a decided need of an outlet for these classes of results, and I have heard others among us express a similar sentiment. On this account I venture to bring the matter before you, in the hope that it will be fully discussed, and, if it seems desirable, some plan of action decided upon.

I anticipate that one of the first objections that will be raised is that it is difficult for existing entomological journals to find matter with which to fill their pages. If this is true, and to a certain extent no doubt it is, it ought not to be much longer, for when the entomologists of the stations get well established they should turn out an amount of work that will more than fill these journals with the short contributions for which they are especially fitted. But the suggested publication is not intended for this kind of matter, and ought to increase rather than decrease the number of contributions to existing journals.

It seems as though some coöperative plan might be carried out by which the opportunities for publication of the results of biological investigation would be greatly increased,—a fact which would also greatly stimulate the prosecution of such investigations.

Among the points that to my mind appear to be desirable to keep in view in carrying out such a project are the following:

(1) To exclude short papers that can easily go in existing journals.

(2) To make little or no attempt at reviews, notices of current events, editorial remarks, etc., reserving the pages entirely for contributed articles.

(3) To place the management in the hands of an editoral committee, by whom the acceptance or refusal of articles submitted for publication should be decided.

(4) To include papers in other departments of zoology, rather than to make it exclusively entomological.

(5) To issue it only as material accumulates, and, for the present at least, not oftener than quarterly.—CLARENCE M. WEED.

The Apple Maggot.—Professor F. L. Harvey, of the Maine State College, has lately published an elaborate article containing the results of investigations made during 1888-89 upon the Apple Maggot (*Trypeta pomonella* Walsh). It consists, as the title-page states, of "a consideration of the literature, history, transformations, life-history, and habits of this insect, also remedies;" and forms by far the best account of the species that has been published.

Professor Harvey has investigated the subject *de novo*, and besides adding a number of new facts to our knowledge of the insect, has corrected several points in its currently accepted life-history. In Maine the flies appear about July 1st, continuing to emerge all summer, and being found in abundance until October. Each female fly is capable of laying at least three or four hundred eggs, which are inserted from time to time, one in a place, by means of a sharp ovipositor through the skin of the apple. The full-grown larvæ leave the fruit after it falls, and pupate at or near the soil surface. The winter is passed in the pupa state, the flies appearing the following summer. The destruction of windfalls is considered the most promising remedial measure. Preventing the importation of infected fruit from other States by law is strongly recommended. The article closes with a critical review of the literature of the species, which leads to this pertinent paragraph: "The above review also suggests the importance of careful work on the part of entomologists that their writings be as free as possible from errors, and that great care should be taken, especially in quotations, to keep theories and surmises distinct from facts obtained by careful research."

The investigations thus recorded were evidently made as a part of the work of the Maine State College Experiment Station, but there is nothing upon the copy at hand to indicate when, where, or by whom it was published.[3]

American Frit Fly.—Professor H. Garman, of the Kentucky Experiment Station, in a recent bulletin (No. 30), describes the life-history of a new wheat fly, supposed to be *Oscinis variabilis* Loew, for which the above name is proposed, on account of its similarity to the European frit fly (*Oscinis frit* L.). The insect has been found infesting grain in Fayette county, Ky., although but little damage has yet been done. Careful descriptions, accompanied by good figures, of the larva, puparium, and adult are given. The destruction of volunteer grain and late planting are the preventive measures suggested.

The Genus Agrotis.—Bulletin No. 38 of the U. S. National Museum consists of a revision of the North American species of the genus Agrotis by Prof. J. B. Smith. Lepidopterists are to be congratulated upon the publication of this paper, for it treats in a clear and systematic way of a group which, as the author well says, was simply "a huge assemblage of species, through which no path was

[3] Since this was written we have learned that the memoir forms a part of the Maine Experiment Station Report for 1889.

visible, and in which identification to any but the specialist, or to one with a large collection, was all but impossible." Professor Smith has greatly restricted the genus Agrotis, leaving but eight species in it, and has proposed for the others a number of new genera, based on definite structural characters. He has also used seven existing generic names. The revision is based on a study of nearly all the important collections of the country, and covers nearly 250 pages.

In the introductory paragraphs we find this significant remark: "I had at one time the strong conviction that genera were natural assemblages, capable of strict limitation and definite in extent. The study of very large material since that time has convinced me that my first impression was erroneous, and that genera as such are mere artificial divisions of convenience, useful for the purpose of identification, and for the expression of relationship, and that they were useful for that purpose just in proportion as they expressed clear and definite associations of characters."

The White Grub.—In the June (1890) Crop Report of the Illinois State Board of Agriculture Prof. S. A. Forbes reports having demonstrated that "the current life-history of our common white grub is mistaken. All our most abundant species complete their growth as grubs in midsummer or early autumn, and form both pupa and adult beetles the same season, hibernating in the earth in this last stage, and coming out in May or June of the next year. Where these grubs are injurious in the fall they may be expected, as a rule, to be even more destructive in the same fields the following spring."

Professor Forbes also announces having obtained evidence that there may be four generations of the Hessian fly, which attack wheat with destructive effect,—two in spring and two in autumn.

Nematodes in Australia.—The August issue of the *Agricultural Gazette*, of New South Wales, is devoted to a discussion of Nematode injury to root crops by Professor N. A. Cobb. It is divided into three sections,—the first treating of the life-history of *Tylenchus arenarius*; the second describing twenty-four species of the genus Tylenchus, with which the author unites Heterodera; and the third discussing the disease and its remedies. This paper will be of great value to all engaged in studying these little creatures.

Miss Ormerod's Manual.—A new and greatly-enlarged edition of Miss Eleanor A. Ormerod's admirable Manual of Injurious Insects has lately been published. The new work forms a volume of over four hundred pages, the mechanical execution of which is altogether

excellent. The main portion of the book is divided into three parts, treating of the insects affecting food crops, forest trees, and fruit crops, respectively. To this is appended a list of the insects discussed, an introduction to entomology, and a glossary of entomological terms. Much has been added, in the author's usual careful and thorough-going style, to the accounts of the first edition, published in 1881. The work will doubtless prove of great value to British agriculturists, and Miss Ormerod is to be congratulated upon its appearance.—C. M. W.

Beetle Parasites.—The braconid parasite of *Lixus concavus*, mentioned on page 972 of last month's NATURALIST, has been identified by Dr. C. V. Riley as *Bracon rugator* Say. I am also indebted to the same authority for determining the parasite of *Tyloderma foveolatum*, mentioned in the same connection, as *Bracon xanthostigma* Cresson.—C. M. W.

ARCHÆOLOGY AND ETHNOLOGY.

Rigveda Studies.—Sanscrit students who have had an insight into Vedic studies know perfectly well that we are only at the beginning as far as a real comprehension of the Rigveda is concerned. In recent years many ripe scholars have striven to render this work more accessible. The joint work of two Halle professors, R. Pischel and K. F. Geldner, entitled "Vedische Studien," marks a great advance in this direction,[1] and intends to refute many erroneous ideas still adhered to concerning that oldest Aryan monument. The treatment of the mythologic element was undertaken by Pischel, whereas linguistics and text-criticism fell to the share of his collaborator.

Both are of the opinion that it is entirely wrong to consider the period when the Vedas, especially the Rigveda, took their origin as a pastoral or nomadic one, undefiled by the civilization or corruption which are characteristic of later historical epochs. The people were then as eager to acquire worldly goods as they ever were in the time of the classical epics called Maha-Bhârata and Ramâyana. They prized artistic ornaments and fine dwellings, knew the art of writing, and were acquainted with the use of salt. The mention of village communities and of walled towns or cities proves that the nomadic

[1] Vedische Studien von Richard Pischel und Karl F. Geldner. I. Bd., Stuttgart, Kohlhammer, 1889, 8vo, 33 and 328 pages.

period had come to an end long before. The wide diffusion of the custom of hetairism could prove by itself alone that the Vedic hymns, in which it is mentioned, are of a relatively late period.

Though the volume is mainly addressed to critical and philological specialists, many points in Pischel's remarks will be of use to every one interested in literary history,—the following for instance:

No one, says he, should start out upon Vedic studies before having laid a firm foundation for these by the perusal of the classical masterpieces, and for a better understanding of the Veda even Pâli and Prâkrit are indispensable. Mythologic comparisons taken from non-Aryan or from other Aryan nations are of very limited use, on account of the difference in time, manners, and ideas. They are likely to lead to very erroneous conclusions. The old Aryan religion, representing powers of nature and centering in Varuna, was on the wane in the Rigveda period; Sûrya, Parjânya, are still in vogue, but a new and purely national religion, with Indra as its central figure, was just coming into ascendency, and even then was more popular, because more thoroughly national and Hindooic, than the Varuna deities. Therefore we cannot expect to find in every god, myth, or folk-tale in the Rigveda a reminiscence of some Aryan god or idea, but have to compare as well the myths of modern India for their Indra folk-lore. Here the natural powers have given way entirely to human feelings and popular humor. The Agni and Soma hymns, with their stiff, mystic, formal, and priestly poetry, are generally superseded by the Indra hymns, with their lively imagination and humoristic vein.—A. S. G.

Schliemann's Ilion.—Those who suppose that the modern Trojan war—that is, the fiery contest between Schliemann and Captain Boetticher—has come to an end are entirely mistaken. Hector-Schliemann is defending his Pergamos as valiantly as ever, though Achilles-Boetticher is invoking all the help he can get from the gods to storm the citadel. In 1889 Schliemann invited Boetticher, with Virchow, Dörpfeld, and other competent men to visit the place personally, and the ruins were viewed on the spot. The report made on Schliemann's side claimed that at the time all difficulties had been settled, for Boetticher had declared that mistakes had been made on his part. Boetticher claims that the ruins, with the seven "cities" superposed to each other, were not cities, but huge cremation places surrounded by walls. Schliemann and Dörpfeld believe that only the third "city" (counted from below) was a crematory with urns. Boetticher believes that the huge *pithoi* or vats of pottery, often twelve feet high, were used for slow cremation of whole bodies of persons.

This Prof. Virchow denies, for notwithstanding the porosity of such vases, it was impossible to establish a draft sufficient for cremation. The most convincing argument of Boetticher for his theory is the smallness of the ruins, for they measure only one hundred and forty metres in length, and about ninety-three metres across,—a space upon which it was impossible to build a city one-tenth the magnitude of Homer's Troy. Boetticher has also demonstrated that at Hissarlik, where the ruins are, no hill ever existed before the first necropolis had gone there into ruins and began to form the mound now in existence. He locates the true city of Ilios upon the heights between Hissarlik and the Rhoeteion, a hill on the southern shore of the Dardanelles.

Before us is a series of five *missives* published by Boetticher after the return from Hissarlik, two of which are illustrated and quite voluminous (one being in French). The author claims to have been unfairly treated at that interview,—that the time set was too short for the purpose, and that he was not allowed to speak freely. So he maintains his former position firmly, and vigorously asserts his claim that the ruins in question are nothing but a necropolis to incinerate bodies after the Assyro-Babylonian fashion. Among the scientists who have given their assent to Boetticher's idea may be named Prof. Moritz Wagner, of Munich; Georg Ebers, of Leipzig; and C. de Harlez, of Louvain. This is said to those readers who rely upon scientific authorities.—A. S. GATSCHET.

Additional Studies of Zuni Songs and Rituals with the Phonograph.—I have already, in a previous number of the NATURALIST, mentioned some of the records of Zuñi songs and rituals which were obtained during the last summer by means of the phonograph. Since the preparation of that paper I have been able to obtain several important additional records, and to revise some of those which were mentioned in my previous notice. Some of these are so important that a mention of them may interest those who are in sympathy with this method of research.

The difficulties in the transportation of the phonograph from the railroad to Zuñi are not as great as might be imagined. Although the trail from Gallup, New Mexico, to Zuñi Pueblo is in places very rough, the instrument suffered no damage from transportation. I found it convenient, however, to take with me the treadle machine, which is more practical for this kind of work than that furnished with the storage battery. The former is, moreover, more bulky, and on that account more difficult to carry over rough roads.

I have been repeatedly asked since my return, "What the Indians

thought of the phonograph?" That question can only be in part answered. What they really thought is unknown to me, but some of their remarks about it were rather interesting. Some of those who gave me songs declared that there was a person hidden in the machine who repeated what they sang; others said that the machine was bewitched. But not one of those whom I asked, except some squaws, seemed afraid of the instrument, or if they were afraid did not manifest it in any way. A Laguna Indian, who was a visitor in Zuñi at the time of my visit, philosophically remarked, as translated for me, that the white men used many machines which he did not understand, and as he knew these were not bewitched there was no reason to suppose that the phonograph was possessed of any such powers. I cannot, however, but think that all who saw the instrument mentally reiterated what the Zuñi silversmith, Kuishte, said to me in Spanish (perhaps not the purest Castalian), "*Melicano sabe mucho.*" I permitted them to hear the records which they had given, and in every case to my question whether the record was accurate or not they responded with that universal Zuñi word to which so many different shades of meaning are given by inflection, *kokshi*, good.

It was my good fortune to witness in Zuñi, in August of the present year, an ancient dance of interesting character. This ceremonial is a corn dance, and is known among the Zuñians as the *Otonarweh.* The ancient name is *Hamponey.* This dance is rarely performed, and has seldom been witnessed by white men, as it occurs only after intervals of several years. The *Hamponey* is reputed by all to be most ancient, and there are many ceremonies in it which indicate its antiquity. It was therefore with great interest that I made elaborate notes upon it, and sought particularly to obtain records of its songs on the cylinders of the phonograph for preservation. Through the kindness of one of the Indians, who occupied an important office in the ceremony, I was reasonably successful with the latter. When one considers the changes which yearly come to the Indians, and the probability that in a few years many of their customs will be greatly modified or disappear forever, the necessity for immediate preservation of their songs and rituals is imperative. In the case of the *Hamponey*, which is celebrated only once in from five to eight years, the necessity of preservation by observers is increased in proportion to the rarity of its occurrence. Eight years in the life of a New Mexican Pueblo may profoundly affect its whole social and religious characters; and when once lost these religious rites and ceremonials, which are survivals of the ancient indigenous culture of the southwestern territories of the United States, are lost forever.

It is my purpose later to publish an elaborate paper on the *Hamponey*, in which will be embodied the songs, set to music, which were obtained by the use of the phonograph, so that it is not necessary to do more in this account than to say that the ceremony is a corn dance performed by women, and somewhat similar to a dance called the *Klăheywey*, yearly celebrated by them. It is a "tablet dance," in which corn is carried in the hands, and takes place just before the harvest. The dance continues for a whole day and night in the open plaza, and most of the ceremonials can be seen by all.[1]

Not far from the site of an old Pueblo of the Zuñi valley, called Halonawan, the "Ant Hill," on the opposite side of the Rio Zuñi from Shewena, the present Pueblo of Zuñi, there is a small shrine known as Herpăhtenăh. This is a very sacred place to the Zuñians, and very interesting ceremonies are performed about it. At the close of the *Hamponey* a solemn procession of participants in the ceremonies of the dance makes a pilgrimage to it. They place in its interior the offerings of prayer plumes, sacred meal and water used in the dance. While I have reserved a description of what takes place at Herpătenăh for another place, a notice of it finds an appropriate place here in connection with my phonographic work on the songs and prayers of the *Hamponey*.

Travellers on the Atlantic and Pacific Railroad may have noticed the splendid flow of lava or "*malpais*" near the road at McCarty and Grant Stations. The appearance of this lava is so fresh that one might say that it was viscid but a few years ago. In places it looks not less ancient than some of the historic lava flows on the sides of Vesuvius. It is reported on good evidence that at certain points along the edge of this flow there are artificial structures, partially covered by this lava. The existence of these would be good evidences of its age as compared with the existence of man in the neighborhood. As additional evidence bearing on this point I have brought to light an old Acoma folk-tale which accounts for its origin. I owe my knowledge of the existence of this tale to Capt. Pradt, of Laguna.

According to this legend an old gambler challenged the sun to play with him. This challenge the sun at first refused to accept, but being taunted with cowardice he played with his challenger, won all that he had, and made him blind. The blind man was in turn taunted by his fellows, and to revenge himself sought the help of a powerful person, who caused the earth-pitch (lava) to rise out of the earth and destroy men and their dwellings. The whole human race, the story goes, would have been destroyed if the snow-birds had not collected together

[1] **Mexicans are not allowed to witness any of the sacred dances of the Zuñians.**

to aid it, and brought with them[1] the snow which cooled off the liquid lava, and hardened it into stone.

Although summer months are not the best in which to obtain folk-tales from the Zuñians, and from some, if not all, of the other Pueblo Indians, I was fortunate enough to get on the phonograph the story of the origin of the lava flow from a Laguna Indian in his own words. Outside of its value as an account of the origin of this stream of lava, it is also interesting as a record—I belive the first on a phonograph—of a specimen of the Queres language, which is spoken by more Pueblo Indians than any of the several linguistic branches characteristic of the sedentary Indians of New Mexico.

Not the least important of the phonographic records which were taken are several prayers used by hunters to their fetishes, and that of a member of the Pitslashewâne, or "Priests of the Bow," used formerly in the wars with their foes, the Navajos. All of these, which form an interesting collection, are reputed to be very old. As their use is undoubtedly dying out, as game decreases and probabilities of war diminish, a permanent phonographic record of these, most of which have been faithfully recorded by phonetic methods, and translated by Cushing in his most interesting paper on Zuñi Fetishes, is an important addition to my collection.

In my previous paper I have stated that I was able to obtain a phonographic record of the Kaklan, or so-called Zuñi epic, a ritual which narrates the history of the Zuñi race. This important and valuable unwritten record of the past of the nation *I was not able to obtain.* When my former paper was written I thought I had obtained it, but I have since detected my error. After the paper was written, when I found that I had been mistaken, I tried in every way to get this ritual in the language of the priest who recites it, but always to be put off with other things, and at last to be refused. There is certainly no more valuable acquisition to be made in a linguistic study of the Zuñi language than to persuade the Indians to entrust this account of their history to the phonograph, but I must confess my failure as yet to bring it about.

The almost illimitable field for research on the languages of our aborigines which presents itself to the student demands more workers. Now is the time to collect material before all is lost. The phonetic

[1] In Pueblo conceptions the frog brings the rain, the butterfly the summer, and the snow-bird the snow. Causes and effects are singularly confounded, and innumerable instances where animals cause atmospheric and climatic conditions in the same way that the snow-birds brought the cold might be mentioned.

methods now in use are good, but phonograph records are easier to make and more satisfactory. While the collection of many cylinders on which the language, songs, and similar records are made is only a means to an end, it is a practical and efficient way for immediate preservation. The scientific study of these records comes later, but now is the time for collection of them. Edison has given us an instrument by which our fast-fading aboriginal languages can be rescued from oblivion, and it seems to me that posterity will thank us if we use it to hand down to future students of Indian languages this additional help in their researches.—J. WALTER FEWKES, *Boston, October 4, 1890.*

The Aryan Cradle-Land.—"It will be for the benefit of our science," said the president of the Anthropological Section of the British Association, "that speculations as to the origin and home of the Aryan family should be rife; but it will still more conduce to our eventual knowledge of this most interesting question if it be consisttently borne in mind that they are but speculations." With the latter, no less than the former, opinion I cordially agree. And as in my address on the Aryan cradle-land, in the Anthropological Section, I stated a greater variety of grounds in support of the hypothesis of origin in the Russian steppes than has been elsewhere set forth, I trust that I may be allowed briefly to formulate these reasons, and submit them to discussion.

(1) The Aryans, on our first historical knowledge of them, are in two widely-separated centers,—Transoxiana and Thrace. To Transoxiana as a secondary center of dispersion the Eastern Aryans, and to Thrace as a secondary center of dispersion the Western Aryans, can with more or less clear evidence, or probable inference, be traced from about the fourteenth or perhaps the fifteenth century B.C.; and the mid-region northwest of Transoxiana and northeast of Thrace—and which may be more definitely described as lying between the Caspian and the Euxine, the Ural and the Dnieper, and extending from the forty-fifth to the fiftieth parallel of latitude—suggests itself as a probably primary centre of origin and dispersion.

(2) For the second set of facts to be considered reveal earlier white races from which, if the Aryans originated in this region, they might naturally have descended as a hybrid variety. Such are the facts which connect the Finns of the north, the Khirgiz and Turkomans of the east, and the Alarodians of the south, with that non-Semitic and non-Aryan white stock which have been called by some Allophyllian, but which, borrowing a term recently introduced into geology, may, I

think, be preferably termed Archean; and the facts which make it probable that these white races have from time immemorial met and mingled in the South Russian steppes. Nor, in this connection, must the facts be neglected which make great environmental changes probable in this region at a period possibly synchronous with that of Aryan origins.

(3) In the physical conditions of the steppes characterizing the region above defined there were, and indeed are to this day, as has been especially shown by Dr. Schrader, the conditions necessary for such pastoral tribes as their language shows that the Aryans primitively were; while in the regions between the Dnieper and the Carpathians, and between the Oxus and the Himalayas, the Aryans would, both in their southwestern and southeastern migrations, be at once compelled and invited by the physical conditions encountered to pass at least partially from the pastoral into the agricultural stage.

(4) The Aryan languages present such indications of hybridity as would correspond with such racial intermixture as that supposed; and in the contemporary language of the Finnic groups Prof. de Lacouperie thinks that we may detect survivals of a former language presenting affinities with the general characteristics of Aryan speech.

(5) A fifth set of verifying facts are such links of relationship between the various Aryan languages as geographically spoken in historical times; such links of relationship as appear to postulate a common speech in that very area above indicated, and where an ancient Aryan language still survives along with primitive customs. For such a common speech would have one class of differentiations on the Asiatic and another on the European side, caused by the diverse linguistic reactions of conquered non-Aryan tribes on primitive Aryan speech, or the dialects of it already developed in those great river-partitioned plains.

(6) A further set of verifying facts is to be found in those which lead us more and more to a theory of the derivative origin of the classic civilizations, both of the Western and of the Eastern Aryans. Just as between the Dnieper and the Carpathians, and between the Oxus and the Himalayas, there were such conditions as must have both compelled and invited to pass from the pastoral into a partially agricultural stage, so, in passing southward from each of these regions, the Aryans would come into contact with conditions at once compelling and inviting to pass into a yet higher stage of civilization. And in support of this all the facts may be adduced which are more and more compelling scholars to acknowledge that in pre-existing Oriental civilizations the sources are to be found, not only of the

Hellenic and the Italic, but of the Iranian and the Indian civilizations.

(7) Finally, if the Hellenic civilization and mythology is thus to be mainly derived from a pre-existing Oriental or "Pelasgian" civilization, it is either from such pre-existing civilizations, or from Aryans such as the Kelto-Italiots, migrating northward and southward from Pelasgian Thrace, that the civilization of Western and Northern Europe would, on this hypothesis, be traced; and a vast number of facts appear to make it more probable that the earlier civilization of Northern Europe was derived from the south than that the earlier civilization of Southern Europe was derived from the north.

The three conditions of a true solution of the problem either of Semitic or of Aryan origins appear to be these: First, the locality must be one in which such a new race could have ethnologically, and secondly philologically, arisen as a variety of the Archean stock of white races; and thirdly, it must be such as to make easily possible the historical facts of dispersion and early civilization. And I venture to submit the above set of facts as not inadequately, perhaps, supporting the South Russian "speculation as to the origin and home of the Aryan family."—J. S. STUART GLENNIE, in *Nature*, October 2d, 1890.

MICROSCOPY.[1]

Lumbricus, Egg-Laying, etc.[2]—In spite of many individual variations, the egg-capsules of the various species of *Lumbricus* are, as a rule, readily distinguishable in form, color, and size. Those of *L. fœtidus*, which are laid in and about manure-heaps, are rather regularly fusiform, varying in color from light yellowish to dark brownish olive; they measure on the average about 4–6 by 2–3 millimeters. The albumen is tough and jelly-like, dissolves with difficulty in water, and becomes of a horn-like consistency after the hardening action of reagents. Each capsule contains from ten to sixty ova, of which not more than ten or twelve undergo development, and this number may be reduced to one or two, particularly in the winter season. The capsules of *L. communis* and *L. terrestris* are

[1] Edited by C. O. Whitman, Clark University, Worcester, Mass.

[2] E. B. Wilson. *Journ. Morphology*, III., 3, Dec. 1889.

deposited in earth, usually a few inches below the surface. Those of the first species are irregularly fusiform, and of a brighter yellow color than those of *L. fœtidus;* they measure on the average about 5–7 by 3–5 millimeters. Those of *L. terrestris* are still larger (mean measurements are 6–8 by 4–6 mm.), regularly fusiform, but more swollen and rounded than those of the other species; their color is a dark olive. In both species the albumen has a slimy, mucus-like consistency, and is not greatly hardened by reagents. In *L. terrestris* only one egg develops out of several included in the capsule. *In L. communis two embryos are produced as a rule, and in many cases, though not in all, both arise as twins from a single ovum, as has been described by Kleinenberg.*

Egg-laying seems in special cases to continue throughout the year, though it is most active in the spring and summer months. I have found the capsules of *L. fœtidus* out of doors in nearly every month of the year, but in mid-winter they are only found in decomposing compost heaps where the temperature is maintained at a tolerably high point. The rate of development varies greatly, and depends not only upon the temperature, but also upon the vigor or other internal properties of the individual embryos, for in late stages the embryos in a single capsule are often found in very different stages of advancement. It is therefore impossible to determine the age of the embryo without following its actual development. In laboratory cultures the young worms usually make their escape from the capsule in about two or three weeks.

Development continues for some time after removal of the segmenting ova from the capsule, but pathological changes invariably supervene, however careful the treatment, and I am persuaded that no trustworthy results can be obtained by this method. After making numerous drawings of embryos thus studied, I rejected them all, and relied wholly on the comparative study of specimens examined or preserved immediately after opening the capsules. The results thus obtained, though based on the examination of a very large number of specimens, are necessarily incomplete; but I believe them to be trustworthy as far as they go.

As in so many other cases, periods of quiescence, or "resting stages," alternate with periods of division throughout the cleavage process. In the resting periods the cells are closely pressed together, and their outlines are often hard to see; so that it is well-nigh impossible to interpret some of the stages unless they are studied in the active period. Moreover, the cleavage process varies greatly in the

order of division, which after the first two divisions loses all appearance of regularity. On account of these circumstances the segmenting ova vary widely in appearance, and the process of cleavage thus acquires that apparent irregularity which other observers have found so perplexing. It is now well known, however, that the segmenting ova of various other animals (*e.g.*, Mollusca, Cœlenterata) are likewise subject to considerable variation, which in some cases at any rate is due simply to temporary acceleration or retardation in the divisions of individual cells (No. 53), and probably does not affect the essential character or the end-result of the cleavage.

Preparation of the Embryos of Lumbricus.[3]—The demonstration of the teloblasts of the germ-bands may be effected in the following manner: Take embryos from .5 to .8 mm. long, place them in fresh filtered lemon juice 5 minutes, and then 20 minutes in 1% gold chloride; and then, for reduction, in a mixture of one part formic acid and four parts water (in daylight). After one or two hours the embryos become reddened and quite soft. They are then to be placed on a slide, the dorsal body-wall torn off, and the isolated ventral wall so placed that its outer surface faces upward. Examined in water, the teloblasts and cell-rows are seen with great distinctness.

For finer purposes the foregoing method is not to be used. It is better to use Flemming's chrom-osmiuo-acetic acid. The embryos remain in this a few minutes, and are then removed to a ⅓% solution of platinum chloride for twice or three times as long. After such treatment surface preparations are best examined in glycerine. Preparations for sections are stained in aqueous hæmotoxylin.

For demonstrating the median ventral plexus of nerve cells, the treatment with lemon juice and gold chloride is followed, except that the reduction is effected in very dilute acetic instead of formic acid (in daylight). After two days (in winter) the embryos are violet colored, and may then be hardened in alcohol (in the dark), and prepared for the microtome in the usual way. In quite young embryos, the epidermis, neural plates, and muscle plates appear clear, and only the nerve cells are stained dark violet.

[3] R. S. Bergh. *Zeitschr. f. wiss. Zool.*, L., 3, Sept. 1890, pp. 474-5 and 484.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Biological Society of Washington—Meeting October 18, 1890.—Mr. H. E. Van Deman, speaking on cultivated fruits in the mountains of North Carolina, said that while scarcely anything had been done in fruit raising for commercial purposes, he believed it would be a profitable investment. Even with the shiftless and slovenly manner of cultivation now in vogue, it was successful. At an altitude of from 2,000 to 3,800 feet the climate is suitable for the growth of apples, and those raised are as fine and keep as well as any grown in the northern States. The flora at the elevation stated being similar to that of New England, he thought the inference fair that fruits succeeding in one place would also succeed in the other. Peaches did not do very well; but the pear, quince, grape, currant, and other northern fruits, he believed could be raised successfully and profitably.

Dr. D. E. Salmon, in discussing the paper, referred to his experience in the region some years ago, and seemed to be rather doubtful that fruit could be successfully raised. The sudden changes from warm to cold often caused a failure in crops, especially with peaches. These last frequently bloom in February, and then the March frosts are fatal to the crop. He did not find the soil as fertile as had been depicted —rather the contrary; and altogether his picture of the beauties of western North Carolina was not as enticing as that of Mr. Van Deman.

Dr. Theodore Gill spoke upon the characteristics of a new family of fishes, the Cyclopteroidea. He referred to the genus Cyclopterus, commonly known as the lump-fish, as having been placed in several different positions in schemes of classification. All the earlier writers had given it a wrong position, and it was only in 1872 that Professor Putnam had placed it where it properly belonged, namely, near the Cottidæ. This Dr. Gill believed to be its true position. Examination of its osseous structure, its nervous system, its digestive system, and other points, all show its near alliance with the Cottidæ, instead of with the Gobiidæ, Gadidæ, or Pleuronectidæ. He gave an outline of the anatomy of the genus, and compared it with other forms, stating his conclusion that its structure showed it to be entitled to rank as the type of a superfamily, which he had named Cyclopteroidea.

Prof. Lester F. Ward spoke on the American Triassic Flora. The best development of this series of strata is found in the Connecticut valley, where great numbers of tracks, formerly supposed to be birds,

but now generally referred to reptiles, have been found. Only a few plants are known from this region. This series of rocks extends through New Jersey and Pennsylvania to Virginia and North Carolina. An outcrop of rocks, presumably of this age, is now known on the Potomac, about twenty miles from Washington. From this point the series passes passes south in a narrow belt, ten or fifteen miles wide, as far as Charlottesville, and is thought to be connected with the Richmond coal field, also Triassic in age. This coal field has yielded many species of fossil plants. They were collected by Rogers, Lyell, Emmons, and others, but no very systematic study has been given the field until recently. Rogers referred the beds to the Oolite of Yorkshire; Emmons referred them to the Permian; Fontaine, within a few years, placed them in the Rhætic, somewhere between the Triassic and Jurassic. The view of Cope, and the one toward which Prof. Ward inclines, is that the Richmond beds, the North Carolina beds, and those of the Connecticut River, really are all of Triassic age, and equivalent to the Keuper group, the upper member of the Triassic in Europe. The total number of plants known from the horizon in North America is comprised in 51 genera and 119 species. These are distributed as follows:

	Genus.	Species.
Problematical organisms, ...	5	9
Ferns, ...	16	36
Equisetaceæ, ...	2	8
Lycopodaceæ, ...	1	1
Cycadaceæ, ...	12	35
Coniferæ, ...	8	19
Monocotyledons, ...	2	2
Doubtful, ...	5	9

The Triassic area is divided into five basins, viz., the Connecticut valley, New Jersey and Pennsylvania, Virginia, North Carolina, and the western area. The species are distributed as follows:

	Total number.	Peculiar to each.
Connecticut River Valley, . .	23	13
New Jersey and Pennsylvania,	18	5
Virginia, ...	56	34
North Carolina, ...	52	25
Western area, ...	13	11

About one-half the number found in the United States occur also in Europe, the largest number of identical species being in the Rhætic, and the next largest in the Keuper.

Professor Ward referred in some detail to the "Problematical Organisms," mentioning in particular the genus Dendrophycus. This was described by Lesquereux from the Coal Measures. Dr. Newberry has more recently described a second species from the Triassic, very similar to Lesquereux's, and Professor Ward referred to a third species which he intended to describe under the name of *D. shumakeri*. This genus is regarded by Dr. Newberry as of vegetable origin, and while Professor Ward did not express a positive opinion as to its nature, he described the *possible* manner of its origin, assuming it to be an Alga. He argued strongly against the idea that because vegetable or carbonaceous matter is wanting the specimen in question or similar ones could not be plants. A discussion of the paper was reserved for the next meeting.—J. F. JAMES.

American Association for the Advancement of Science.—At the Indianapolis meeting the following officers were chosen for the ensuing year:

President: Albert B. Prescott, Ann Arbor, Mich.

Vice-Presidents: A (Mathematics and Astronomy), E. W. Hyde, Cincinnati, Ohio; B (Physics), F. E. Nipher, St. Louis; C (Chemistry), R. C. Kedzie, Agricultural College, Mich.; D (Mechanical Science and Engineering), Thomas Gray, Terre Haute; E (Geology and Geography), J. J. Stevenson, New York; F (Biology), J. M. Coulter, Crawfordsville, Ind.; H (Anthropology), Joseph Jastrow, Madison, Wis.; I (Economic Science and Statistics), Edmund J. James, Philadelphia.

Permanent Secretary: F. W. Putnam, Cambridge, Mass.

General Secretary: Harvey W. Wiley, Washington, D. C.

Secretary of the Council: A. W. Butler, Brookville, Ind.

Auditors: Henry Wheatland, Salem, Mass.; Thomas Meehan, Germantown, Pa.

Treasurer: William Lilly, Mauch Chunk, Pa.

Proceedings of the Natural Science Association of Staten Island.—October 9th, 1890. Mr. Davis exhibited an egg of the black and white creeper, and read the following memorandum in connection with it:

On the 30th of last May, while in the woods to the northwest of Richmond village, in company with Mr. Leng, I observed a black and white creeper (*Mniotilta varia*) hopping down a tree trunk and holding a caterpillar in her bill. Within a yard of the base of the tree, and well hidden in a close clump of beech sprouts and dead leaves,

was the nest, containing two young. Later in the day I found another nest near the base of a tree, which was concealed by dead leaves only, being nearly covered by them. A dead branch served as an arch or doorway to the nest, which contained three eggs. These nests were made of dead leaves, strips of bark and grass, and were lined with rootlets intermingled with a very few hairs. Woodland brooks abound in soft mossy masses of roots that are put forth by the trees growing near their beds, and it is probable that the supply of nest lining was procured from the stream near by. Mr. Samuels says in his "Oology of New England Birds," that the nest is "lined with cotton from ferns, soft grass, or hair." Nuttall, in the description of the nest found by him, says, "the lining was made of a thin layer of black hair." Black and white creepers have several times been observed throughout the summer on the Island, but they were particularly numerous during the one just past, and this is the first recorded instance of the nest haying been found here.

A specimen of *Lymnæa palustris* was presented by Mr. Davis, with the following memorandum:

A species of fresh-water snail was collected some years ago in the brooks flowing into Old Place creek. It was quite plentiful there. The past spring a specimen was handed to Mr. Sanderson Smith, who pronounced it *Lymnæa palustris*, an addition to the list of Staten Island Mollusca.

The following objects, presented by Mr. Wm. Olliff, were shown: Fragments of a large decorated Indian pot, two celts or skin-scrapers, and several examples of concretions,—all from Tottenville and vicinity. A stone axe, found while digging a trench for gas-pipe on Richmond avenue, Clifton, was presented by Mr. James W. Alleh.

Mr. Thomas Craig showed plants of *Lemna trisulca*, an addition to the flora of the Island, found in streams in the Clove Valley. Also *Azolla caroliniana*, from the same locality, where it has evidently become thoroughly established since its introduction there by Mr. Samuel Henshaw in 1885. (See Proceedings for Dec. 11th, 1886.)

The United States National Academy of Sciences.— The Academy met in Boston on November 11th and 12th. The following papers were read: [1] On the Primary Cleavage Products formed in the digestion of the Albuminoid, Gelatin—R. H. Chittenden. [1] On the Classification and Distribution of Stellar Spectra—Edward C. Pickering. On the Relation of Atmospheric Electricity, Magnetic Storms, and Weather Elements to a case of Traûmatic Neuralgia—R. Catlin

(introduced by S. Weir Mitchell). [1] On the Growth of Children studied by Galton's method of Percentile Grades—Henry P. Bowditch. [1] On Electrical Oscillations in Air, together with Spectroscopic Study of the motions of Molecules in Electrical Discharges—John Trowbridge. [1] Some considerations regarding Helmholtz's Theory of Dissonance—Charles R. Cross (introduced by F. A. Walker). [2] A Critical Study of a Combined Meter and Yard upon a surface of Gold, the Meter having subdivisions to two millimeters, and the Yard to tenths of inches—W. A. Rogers. On Evaporation as a disturbing Element in the determination of Temperatures—W. A. Rogers. [2] On the use of the Phonograph in the Study of the Languages of the American Indians—J. Walter Fewkes (introduced by Alpheus Hyatt). [1] On the Probable Loss in the Enumeration of the Colored People of the United States at the Census of 1870—Francis A. Walker. On the Capture of Periodic Comets by Jupiter—H. A. Newton. On the Proteids of the Oat Kernel—Thomas B. Osborne (introduced by S. W. Johnson). On the Present Aspect of the Problems concerning Lexell's Comet—S. C. Chandler. [2] The Great Falls Coal Field, Montana; its Geological Age and Relations—J. S. Newberry. Notes on the Separation of the Oxides in Cerite, Samarskite and Gadolinite—Wolcott Gibbs. On the Relationships of the Cyclopteroidea—Theo. Gill. On the Origin of Electro-Magnetic Waves—Amos E. Dolbear (introduced by John Trowbridge).

[1] Read November 11th. [2] Read November 12th.

SCIENTIFIC NEWS.

John Rafs, a student of the Desmids, died at Penzance, July 14, aged eighty-three years.

Dr. L. W. Schaufuss, the entomologist, died July 19, at Dresden, Germany.

Dr. Alexander von Bunge, formerly Professor of Botany at Dorpat, died in Livland, July 18, aged eighty-seven years.

Peter Maasen, a lepidopterist of Dusselforf, who has made a specialty of the Saturniidæ, died August 18.

The Society of Physics and of Natural History of Geneva celebrated the one hundredth anniversary of its foundation October 23.

Alfonse Farre, formerly Professor of Geology in Geneva, is dead at the age of seventy-seven years.

Dr. A. Müller, formerly Professor of Mineralogy and Geology in the University of Basel, died July 3.

W. Kitchen Parker, the well-known anatomist of London, died in that city, July 3, aged sixty-seven years.

Dr. Ernst Weiss, the author of a work upon the plants of the Carboniferous, died in Berlin, July 4.

Dr. W. Waagen, of Prague, has been called to the chair of Geology in the University of Vienna as successor to the late Prof. M. Newmayer.

E. Ray Lankester has been made ordinary Professor of Zoology in the University of London.

Dr. Carl Chun, of Königsberg, has been called to the University of Breslau, as successor to Prof. A. Schneider.

D. Oliver has resigned the directorship of the Kew Herbarium. His assistant, J. G. Baker, has been promoted to the place thus left vacant.

Sir Warrington W. Smith, the geologist, died in London, June 19, aged seventy-three years.

Prof. St. George Mivart has been elected Professor of the Philosophy of Natural History in the University of Louvain.

Mr. G. C. Bourne has resigned his position as Director of the Marine Biological Laboratory at Plymouth, England.

The Abbe S. A. Marseul died in Paris, April 16, 1890, in his seventy-ninth year.

Professor Franklin C. Hill, D.Sc., Ph.D., Curator of the E. M. Biological Museum, Princeton, died recently of heart-disease. Professor Hill, who was sixty-three years old, was educated at his father's private school in Philadelphia. He also studied medicine there, and after graduation entered Harvard, where he studied engineering, graduating there.

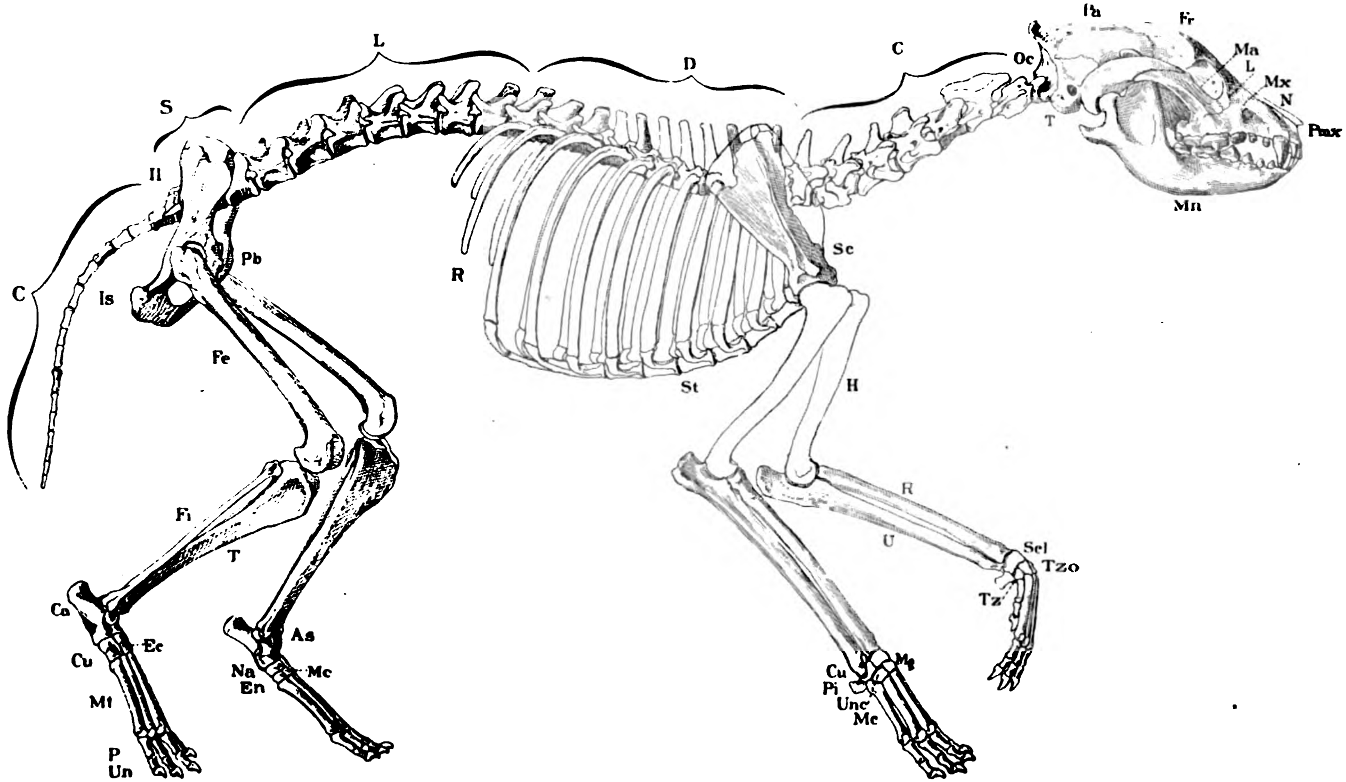
"In loving memory of Frances Evans, daughter of Joseph Phelps (of the island of Madeira), born August 21, 1826; married John Evans July 23, 1859; died at Nash Mills, Hemel Hempstead, September ber 22, 1890."

These are the simple but touching lines of the mourning card telling us of the death of a loving wife and the loss and grief of an affectionate husband. Prehistoric anthropological science has met a loss in her death not indicated in the notice, and which merits more than the formal announcement.

Mr. John Evans is well known in other countries than his own; but the nearer his home the more his worth is recognized. He is a self-made man, has made a fortune by his own exertions and ability, and has as well made a name in science. He is numismatist, geologist, archæologist, anthropologist, and geographer, and occupies a high position in these societies in Great Britain. He is author of the leading works on the prehistoric implements and objects of stone and bronze of Great Britain. His house is a museum and library combined, and is filled with rare and costly specimens. It is also a home, one of elegance and luxury, and here reigned as queen the subject of this sketch. How much of the scientific attainments of Mr. John Evans was due to the aid, counsel, and encouragement of his wife no one but he can know. She was his partner, helpmeet, assistant; she kept his references, was custodian of his papers, and virtually the curator and keeper of his museum and library. She accompanied him in his many journeys, going everywhere throughout Europe; she listened to and applauded his speeches, and was the comfort and solace of his life. She looked forward with bright anticipations to visiting the United States at the proposed International Geological Congress in 1892. Science has lost more in her death than it knows of. Her bereaved husband has my sincerest condolence and sympathy.—T. W.

Miss Cooper, a daughter of the novelist, James Fenimore Cooper, states that when in Paris she saw a French translation of her father's tale, "The Spy," in which there were several mistakes, but one of them was such that it was almost incredible that any one could possibly have been guilty of it. The residence of Mr. Wharton, one of the characters who figure in the story, is spoken of by the author as "The Locusts." Now, the translator had been evidently ignorant of the circumstance of there being any species of trees bearing this name. Having, therefore, looked out the word in his dictionary, and finding the definition to be given as "les sauterelles" (grasshoppers), thus he rendered it in the text. Presently, however, he came across a paragraph in the novel in which it was stated that a visitor to the house of Mr. Wharton had tied his horse to a locust. Then it might be naturally supposed that the translator would have at once discovered his error. Not a bit of it! His reasoning would appear to have been somewhat on a parity with that of a celebrated countryman of his when he declared that "if the facts do not agree with the theory, so much the worse for the facts." Nevertheless, the writer seems to have been conscious that some explanation was due of so extraordinary a statement as that a horseman had secured his steed to a grasshopper. So he went on to gravely inform his readers that in America these insects grow to an enormous size, and that in this case one of these—dead and stuffed—had been stationed at the door of the mansion for the convenience of visitors on horseback.—*Bookmark.*

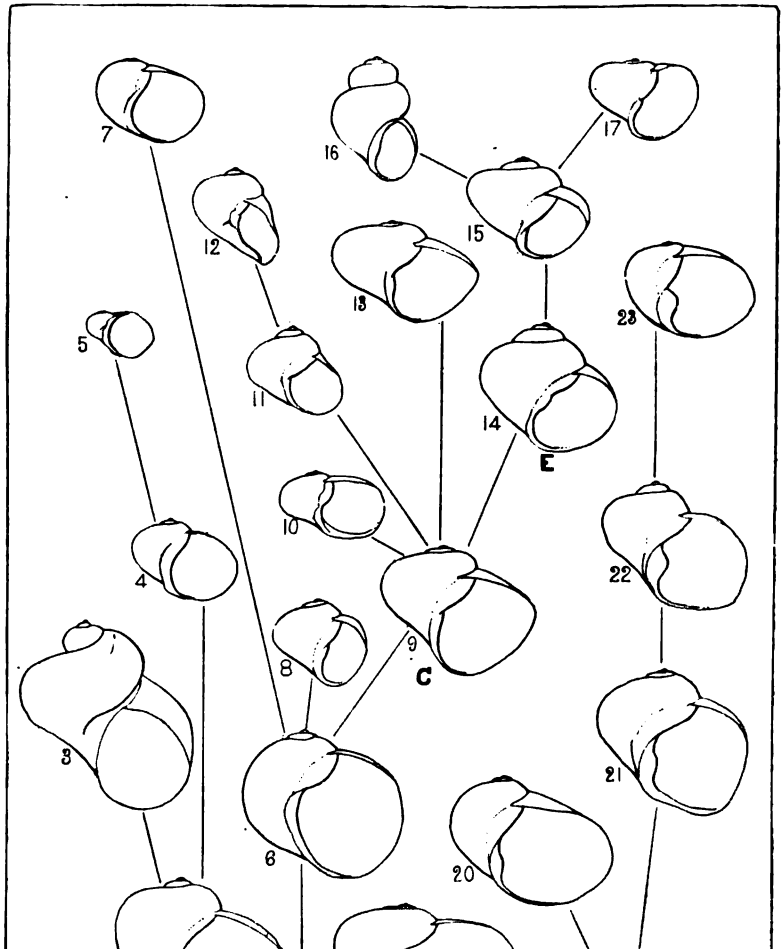
PLATE XXXII.



Aelurodon saevus Leidy; much reduced. Restored from skeleton in collection of E. D. Cope.
The unshaded portions supplied.

(*Opposite page 1058, Nov., 1890.*)

PLATE XXXIII.



STREPTOSTYLUS.

THE

AMERICAN NATURALIST

VOL. XXIV. DECEMBER, 1890. 288.

THE NATICOID GENUS STROPHOSTYLUS.[1]

BY CHARLES R. KEYES.

AMONG the well-marked generic groups defined by Conrad is one to which the name Platyostoma was applied. This term was proposed in 1842;[2] and since that time it has come into common use in American Paleontology. The group embraces a considerable number of familiar species, ranging in geologic time from the Niagara epoch to the close of the Paleozoic. It is rather unfortunate, therefore, that the term had been preoccupied, having been used in generic diagnoses on at least four different occasions. Megerle early applied this name to certain mollusks closely related to Buccinum; but so far as is known no formal publication of the term was ever made. Were this the only obstacle in the way, Conrad's genus might be allowed to stand, for the reason that Megerle's proposition was only in manuscript. Klein,[3] however, proposed *Platystoma* in 1753 for a genus of Cyclostomacea. Meigen[4] adopted the same term in 1803 for certain flies, and Agassiz,[5] in 1829, also used it for a section of Silurid fishes. The preoccupation of Conrad's Platyostoma by Klein's Platystoma, like a number of similar cases, has been objected to on the ground that the two terms, while derived from the same words, are not identical, because Conrad's compound has a connecting *o*. It is

[1] Read before the Iowa Academy of Sciences, September 5, 1890.

[2] *Jour. Acad. Nat. Sci.*, Phila., Vol. VIII., p. 275.

[3] Teut. Meth. Ostr., 1753.

[4] *Illig. Mag.*, Vol. II., 1803.

[5] *Pois. Foss.*, Vol. II., 1829.

quite manifest, however, that both generic words are taken from *platys* and *stoma;* and that from these it was the intention of Conrad to construct a correct generic term. In this attempt he used by mistake the connecting *o*, which is necessary in forming compounds from most Greek words, but which in the present instance was not called for, since the term is formed directly without the intervention of a copulatory vowel. For these reasons Conrad's and Klein's proposals cannot be regarded as distinct.

Since it is clear, then, that Platystoma cannot be retained for the American group of Paleozoic gastropods, some other term must be adopted. Fisher[6] has taken advantage of the questionable validity of Conrad's name, and has recently proposed Diaphorostoma for the same group, with *Platystoma niagarensis* Hall for his type. This writer places Hall's Strophostylus as a subgenus under Diaphorostoma; while Zittel[7] assigns Hall's section to a similar taxonomic rank, but under Platystoma. Had Conrad's type of Platyostoma not been a form midway between the two extremes of a series forming the group Fisher's name might be retained, but the type of Strophostylus is congeneric with *P. ventricosum;* and as this name is the next proposed it must be taken into consideration. Were it not for this fact two sections of this group of shells could be with great propriety made. As regards the term Strophostylus, it was established by Hall[8] in 1859 for certain shells closely related to Platystoma, but differing chiefly in having a slightly "twisted or spirally grooved columella."

Recently a large series of the most important species of both Platystoma and Strophostylus was examined and the matrix carefully removed from the apertural portions of many of the shells. The structural features disclosed in the various forms show a relationship between the two established genera that was long suspected. It is well known that the type of Conrad's genus —*Platystoma ventricosum* Con.—is a somewhat globose shell with a small spire elevated slightly and having the aperture broadly ovate. The inner lip is somewhat thickened and subangular

[6] Man. de Conch., p. 756.

[7] Handb. der Palæ., I. Band, 2 Ab., p. 217.

[8] Palæ. N. Y., Vol. III., p. 303.

within, giving a slight indication of a columella. In all respects it very closely resembles the typical forms of *Strophostylus cyclostomus* Hall from the Niagara shales of Waldron, Indiana. The shells described under Platystoma subsequent to the appearance of the original diagnosis vary more or less from the typical species. The general tendency, however, has been to include under Conrad's genus those forms having a rather small, depressed spire, the inner lip rather thin, and simply reflected over the body-whorl. Often the lip does not touch the second volution and the mouth of the shell is frequently free for a considerable distance. Some of these forms closely approach Paleozoic species of Capulus.

When, in 1859, Hall examined the interior of a Platystoma-like shell (which he afterwards called *Strophostylus andrewsi*), he found that the specimen had the inner lip considerably thickened and somewhat angular within. As a matter of course the interior angularity appeared twisted on account of the continued enlargement of the shell to the adult stage. In some individuals the thickening was considerably exaggerated, and formed a short projecting lamella or ridge. But from the figures given by Hall it is clear that this was not entirely characteristic, and the two specimens figured in the text differ widely in this particular. Nevertheless Strophostylus was proposed and has since been applied to nearly a score of species.

The limits of Conrad's and Hall's genera have never been precisely defined in the descriptions of species, and the larger majority of the forms in question have manifestly been assigned to their respective groups more on account of the general shape of the shells than from an examination of the columellar parts, which were only in exceptional cases visible without the removal of the hard matrix.

From the foregoing it is evident that Strophostylus and Platystoma are practically identical, and that therefore the two must be regarded as synonymous. The type of the first section, *Strophostylus andrewsi*, actually stands at one extremity of a rather extensive and variant series of shells of which *Platystoma ventricosum* is one of the median members. At the other ex-

tremity are the capulus-like forms, similar to those described by White and Whitfield as *Platyceras bivolve*.

The synonymy of the genus is as follows:

1842. Platyostoma, Conrad, Jour. Acad. Nat. Sci., Phila., Vol. VIII., p. 275. (Not Klein, 1753; nor Meigen, 1803; nor Agassiz, 1829.)

1859. Strophostylus Hall, Palæ. N. Y., Vol. III., p. 303.

1885. Platystoma Zittel, Hand. der Palæ., Band I., 2 Ab., p. 217.

1887. Diaphorostoma Fisher, Man. de Conchl., p. 756.

The following species are regarded as members of the Strophostylus group. Of the species originally described under this genus as understood by Hall, and under Platystoma, several have not as yet been sufficiently examined to determine definitely their generic position. The majority of those omitted, however, are mere internal casts or fragmentary individuals, which have no value whatever morphologically; and from a geologic standpoint possess only doubtfully generic interest.

Strophostylus andrewsi Hall.
Platystoma arenosum Conrad.
Platyceras bivolve White and Whitfield.
Platyceras billingsi Hall.
Strophostylus cancellatus Meek and Worthen.
Strophostylus cyclostomus Hall.
Strophostylus elegans Hall.
Strophostylus fitchi Hall.
Platystoma lineatum Conrad.
Strophostylus matheri Hall.
Platystoma niagarense Hall.
Strophostylus obtusus Hall.
Platystoma peoriense McChesney.
Platystoma pleurotoma Hall.
Platystoma strophium Hall.
Strophostylus transversus Hall.
Platystoma turbinatum Hall.
Strophostylus unicus Hall.
Pleurötomaria unisulcata Conrad.
Strophostylus varians Hall.
Platystoma ventricosum Conrad.

Strophostylus, as now understood, embraces three rather well-marked types of shells. One of these sections contains chiefly those extreme forms upon which the genus was originally founded. These shells are subglobose, with the spire somewhat elevated; the columellar parts are prominent, and the front portion of the inner lip is considerably thickened, often having a distinct depression or groove which continues inward around the columella. This group finds its greatest development in the Upper Silurian. Another section includes shells similar to *Strophostylus* (Platystoma) *niagarensis*, in which the spire is depressed, the inner lip simply anchylosed to the body-whorl, and thickened to little or no extent. These forms predominate in the Devonian. They closely approach certain Capuli which have been called Platycerata, and it is very probable that the generic position of a number of species in the latter genus will be modified upon more critical examinations of all the forms. To the third section belong chiefly Carboniferous shells like *Strophostylus* (Platystoma) *peoriensis* McC.

The most striking points of difference in the various forms here referred to Strophostylus are found in the columellar region and along the inner margin of the aperture. The columella is in no species perforated for the umbilicus. In those species showing these parts in the greatest perfection there is a considerable thickening of the forward portion of the inner lip. This thickening is frequently more or less distinctly grooved within, parallel to the apertural margin, and consequently a prominent ridge often borders the groove towards the interior. As the shell increased in size the inner lip became reflexed, making the parts still more massive. The spiral ridge around the axis of the shell thus acquires considerable prominence in some places. In the extreme forms, as *Strophostylus andrewsi*,—the species upon which Hall based his genus,—the columellar ridge forms a kind of elevated lamella, but this exaggeration is by no means constant in the different shells of the species, and in some specimens it is scarcely more conspicuous than in certain individuals of typical *Strophostylus matheri*, or even examples of *S. cyclostomus*. Through the latter two closely allied forms the transitions are made in easy

stages to *S.* (Platystoma) *ventricosus.* In some of the varietal examples of the last-mentioned species a peculiar change in the inner lip begins to make its appearance. But this feature is perhaps better shown in a large series of *S. niagarensis*, its near congener. The lip, instead of being firmly united and fused with the body-whorl, as is the case with most of the forms originally described under the genus, commences to separate from the adjoining volution. In these shells the columellar parts become greatly reduced, and even almost wholly reduced, while the thickening of the inner lip entirely disappears. Nor does the change in this feature end here. Many of the individuals show a tendency to uncoil, some of them having the last whorl separated from the preceding volution by more than half a turn (Pl. XXXIII., Fig. 3). The resemblance of certain varieties to some forms of Capulus (Platyceras of Conrad) is very striking, as has been remarked elsewhere.

The genetic relationships, as at present understood, of the leading species of Strophostylus are graphically represented in the accompanying scheme (Pl. XXXIII.). The earliest-known forms of this group are from the Niagara rocks; but the extended vertical range of such species as *S. ventricosus* would indicate that the specific type has a higher antiquity than present information would suggest. Three principal series developed from this primitive type: (A) one preserving more or less distinctly the original characters; (B) another degenerated more or less, giving rise to loosely coiled shells and those approaching the Capulus group; and (D) a third exhibits intensified features which are particularly noticeable in the region of the columella. Fig. 1 represents the species upon which Conrad based his genus Platystoma, and was called *P. ventricosum.* It chances to be the most generalized as well as one of the oldest forms of the group. The series D showed a continued progression in the development of the axial parts, and finally ended in a form having a conspicuously twisted columella, as was acquired by *S. andrewsi* (Fig. 23). This exaggerated character in the species last alluded to was the basis of Hall's genus Strophostylus. But it will be seen at once that the species selected was actually an extreme development of a variant

series, and is connected by a complete gradation of forms with the earlier and less specialized one. Later in the history of the most primitive form now known an exceedingly variable series (C) is given off, which assumes in the several species diverse characters. Some vary more towards the *S. andrewsi* type, while others tend towards the *S. niagarensis* section. In the variable forms of *S. turbinatus* some significant phases are presented which suggest the relationship of these shells to certain other genera. In the extreme form appears an elevation of the spire that is unknown elsewhere in the group. Some examples show scarcely any thickening of the inner lip or columella, while others have these features well developed.

It must be borne in mind that the scheme as here represented is intended to indicate merely the lines along which the several developments took place, rather than the phylogenetic history of the group. The correct determinations of the phylogeny of animals from paleontological evidence is attended with many difficulties. For, as repeatedly shown by Darwin and others, new variations tend to be transferred backward in the ontogenetic history of a species, and may disposess older characters. This, taken in connection with the fact that variant changes may occur in one part of an organism without materially affecting other parts, calls for extreme conservatism in passing judgment on phylogenetic problems from evidence afforded by fossils.

Explanation of Plate XXXIII.

Fig. 1. *Strophostylus ventricosus* Conrad, Lower Helderberg. 2. *S. niagarensis* Hall, Niagara. 3. *S. niagarensis* var., Niagara. 4. *S. niagarensis* var., Niagara. 5. *S. bivolvis* White and Whitfield, Lower Carboniferous. 6. *S. ventricosus* Conrad, Oriskany. 7. *S. peoriensis* McChesney, Upper Carboniferous. 9. *S. lineatus* Conrad, Upper Helderberg. 10. *S. lineatus* var. *calosa*. 11. *S. varians* Hall, Upper Helderberg. 12. *S. varians* var., Upper Helderberg. 13. *S. lineatus* Conrad, Hamilton. 14. *S. unisulcatus* Conrad, Upper Helderberg. 15. *S. turbinatus* Hall, Upper Helderberg. 16. *S. turbinatus* var. *cochlea*, Hamilton. 17. *S. turbinatus*, var. 18. *S. expansus*, Oriskany. 19. *S. cyclostomus* Hall, Niagara. 20. *S. transversus* Hall, Oriskany. 21. *S. arenosus* Conrad, Lower Helderberg. 22. *S. matheri* Hall, Oriskany. 23. *S. andrewsi* Hall, Oriskany.

CONTRIBUTION TO THE KNOWLEDGE OF THE TERMITES.

BY FRITZ MÜLLER.[1]

IN the opinion of profound students (Hagen in Linnæa Entomologica, 14, page 126) respecting the surprising multitude of different conditions which exist in Termite colonies, only the nymphæ with short wing-cases formed until now an insoluble mystery. As an introduction to the effort to bring this mystery nearer to a solution, I will mention some facts about the family life of the Termites. At a certain season (for different species differ) the winged males and females leave the nest in which, several weeks before, their last moulting has taken place, and raise themselves up in thick swarms in the air. After a short flight they sink to the ground, and rid themselves of their wings. During this begins the search of the male for a mate, and the successful pair try to get a nest for their eggs. Before they accomplish this intention, the majority of the defenceless animals are overwhelmed by the persecutions of the common ants, the birds, and other enemies. Only after a pair as king and queen have found admission in a nest follows a true matrimonial state, during a year, as the result of a betrothal celebrated outside of the nest. The fructification takes place neither in the air nor at all outside of the nest. This representation agrees in nearly essential points with that which Smeathman has given nearly one hundred years ago (1781), but the later zoological books seem to differ from it. Some writers seem to think that the Termites couple (copulate) in the air, or at least, outside of the nest, and that the males perish afterward, and the fructified females are brought back into the nest.

That the male with his female return again to the nest, and live as king and queen, needs no further proof, for besides Smeathman, Lavage, Lespes, Bates, and others have found such kings with different species. Also, later, Dr. Hagen declares

[1] Translated from the German by Mrs. Lucy Bronsen Dudley.

that the existence of such a king appears certain beyond doubt, from the manifold statements of reliable observers, and from numerous specimens of such nest-dwellers (Hagen 12, page 16, and at other places). And I also have found the king with eight or nine species of the genus *Calotermes* (*rugosus*, *nodulosus*, *hagenii*), *Termes lespesii*, *Eutermes inquilinus*, *Anoplotermes pacificus*, and others.

At the time of the swarming the reproductive organs are very small; after the return to the nest they grow so large that they fill the greater part of that sometimes much-swollen hinder part of the body. So there is no doubt about the probable, often-repeated fructification in the interior of the nest; by this, of course, a former fructification outside of the nest is not excluded, though it is very uncertain at the time of the swarming, for the reproductive organs (testicle and ovary) are then so little developed. Burmeister could not discover the interior reproductive parts of the winged animals, even of one of the larger species (*Termes dirus*); and also Dr. Hagen examined many (alcohol) specimens of winged Termites without finding reproductive organs. (Communication by letter of Nov. 25th, 1871.)

Some even take the majority of a Termite swarm as sterile individuals. By this it can be understood how small the reproductive parts of the winged animals are in comparison to their later enormous circumference; for example, I will state that with the winged males of our largest Eutermes species the reproductive organ (testicle) is scarcely 0.3 mm. in diameter. If the Termites possessed the seed-thread of the other insects, so striking to the eye as scarcely to be mistaken, then would the question be easy enough to decide whether the winged males would be able to fertilize the females outside of the nest. In mature kings (sexual males) of different species I found in the reproductive organ (testicle), only partly larger, very pale, roundish little bodies of about 0.008 mm. in diameter (with *Eutermes vernalis*, masculine) which seem to be without a cover. If water is added it increases in size as large again as before. Partly smaller ones, pretty strong and light-refracting little balls, have been found, scarcely 0.002 mm. in diameter. The former are probably the

fructificating ingredient of the semen. They are so pale, and their form is differentiated so little, that I cannot say with precision whether they are found with the winged males. I have until now looked in vain in the reproductive organ (semen pocket) of the queens, as well as in that of the winged females. If I have rightly seen, those with the winged males (the large-ball, nest-building Eutermes) already exist, but still enclosed in cells.

Until now, a couple of Termites have not been caught in the act of fructification (copulation). What may have been taken for it are the pleasure walks of the couples, many times observed, which they take together, the female in front and the male close behind, often seizing the hinder body of the female with his mandible. These peculiar walks have I seen repeatedly with the species *Termes lespesii*. Of this kind I brought matured individuals (imago) out of the nest into a glass. They seemed to have the habit, after a short restlessness, to become heaped over each other in thick layers, as they had been accustomed to sit quietly at the bottom in the chambers of the nest. I poured them on a sheet of paper, and they pushed themselves gradually, one couple after the other, out of the crowded heap, so as to get slowly away from the heap.

Some couples, however, separated themselves soon again; these were two males, as far as they could be examined. The others, which kept together, consisted always of a female in front and a close-following male; the latter was up to the hinder half of the wing, or in case the wings had been already thrown off, completely hidden under the wings of the female. If it was sometimes a step backward, the female seemed to wait for it. Not seldom had the male really seized for a time, with his mandibles, the point out of the hinder body of his mate (as Rosenschold gives, and not apparently, as Lespes saw with *Termes lucifugus*). It seemed to be a sort of bridal caressing. Of fertilizing I have seen as little as Smeathman, Rosenschold, Lespes, Tollin, and others. The object of these pleasure walks is probably to find a nest for a new home for their species.[2]

[2] Ménétriès relates, in a curious report of mixed truth and error (Linn. Entomologica, page 116), that these pleasure walks ended with fertilization.

I believe this statement is doubtful, just as much as that of the Termites of Serra da

I would pass over in silence the pretended congress (copulation) in the air if Azara and Rengger had not claimed to have seen the same in Paraguay, and they rightfully have the reputation of good, reliable observers. In this instance of the Termites, however, they have not justified this reputation, for Azara gives the Termites six wings, and Rengger found the ground covered for fifteen minutes with male Termites, or at least their wings. Unfortunately he says just as little as to how he could make out the wings to belong to males, as in what way the copulation in the air took place.

Rosenschold relates, also, that out of the thick swarms of an indigenous kind the animals fall down in couples, so that the above-mentioned pleasure walks may begin. With the poor ability to fly, and the deficiency of reproductive organs of the Termites, the copulation in the air I think to be distinctly impossible. So much in justification of the statements of Smeathman, as against the different opinions of scientific zoologists. His representations of the reproductive (sexual) life of the Termites seems—as far as I can judge from the facts collected in Hagen's monograph—to be exactly right from my own experience. However, this point is yet incomplete for many other species, if not for those observed by Smeathman (*Termes bellicosus*). It finds therein no consideration for nymphæ with short wing-cases, or better wing beginnings.[3] These animals have been ob-

Mantiquera denuding the trees of the foliage to carry the leaves to their nest is probably a mistake (with ants of the species Œcodoma); that the males of these Termites have stronger mandibles than the females, and that the latter already in the first two or three days after their return home lay their eggs. With other species at this time quite unripe eggs are thrown out of the nest, and some places in Brazil roasted mandioc roots furnish the chief nourishment of the inhabitants, etc. Ménètriès never found, during a five years' sojourn, a Termite in really virgin forests in different provinces of Brazil, which probably all together have more Termites than our St. Catherines. In my own native forest live more than a dozen species.

[3] The name wing-cases is applicable only for the oldest nymphæ which have passed beyond their wing beginnings. Real wing-cases will be developed at the next moulting, and are not present in cases where the wings are not developed.

Dr. Hagen is correct (Linn. Ent. 14, page 126) in blotting out the so-called short wing-cases of the soldier nymphæ from the line of forms of the Termites as very unwarranted. But there are soldiers with wing attachments, out of which wings ought to become veloped; if not soldiers at all, remain wingless (Hagen and at other places, page 102); just as those described by Dr. Hagen as soldiers of the *Termes* (*Termopsis?*) *occidentalis* Walker, and those of the *Calotermes smeathmanii*.

served many times, and were first described by Lespes particularly. The same difference is found among the nymphæ of *Termes lucifugus*, which he observed with two different forms in Bordeaux.

The nymphæ of the first form are livelier, thinner, and have long and broad wing beginnings quite covering the front part of the hinder body. They begin to color the first of May, and change themselves into winged animals between the 15th and 20th of May.

The nymphæ of the second form are more seldom found; they are thicker, more clumsy, and have small short wing beginnings placed sideways. In February, as Lespes first found them, these second nymphæ had the same size as the other (6 to 7 mm.); later they become larger (8 to 10 mm.); but the hinder part of the body grew considerably, particularly in the females. The rear part has grown so fast that the back shields do not continue to cover the sides, but become divided on top by a soft skin. With this swelling of the hinder body is correspondingly a stronger development of the procreative organs. The female nymphæ of the first form had shortly before the last moulting, in each ovary, perhaps twelve tubes, of which only two or three contained unripe eggs. On the contrary, with the nymphæ of the second form, were found as many as fifty-six tubes in which the eggs became visible with older nymphæ. Also the male procreative organs were much more developed in the second form, and the nymphæ outlive the transformation and the swarming of the others, and grew on as nymphæ. They only begin to turn brownish in July, and always become at this time more rare. The observations of Lespes unfortunately only reached to this season. He supposes that the nymphæ of the second form change to winged males and females, and swarm in August, and that out of them come forth a king and queen.

While the smaller couples of wingless males and females are derived from the nymphæ of the first form, these he sometimes found in the nests of *Termes lucifugus*, and called them "little kings and little queens." This conclusion is reached only on account of the development of the procreative parts of king and queen as compared to those with the nymphæ of the

second form, and the development of the procreative parts of the "little king and little queen," as compared with those of the nymphæ of the first form. These different magnitudes, and these different developments of the procreative organs of the captured kings and queens of Lespes may be explained by supposing that they belong to growths of the different years.

Dr. Hagen has already said—against this conclusion of Lespes—that in all kings and queens examined until now, the wing-scales show exactly the form and size of the imago. This development cannot be brought at all in harmony with the little rudimentary wing-cases of those nymphæ. It seems also improbable that these nymphæ with their last moulting may draw out of the rudimentary sheath only wing-scales. So much the more, as the scales of a royal pair every time show exactly the places from where the wings are broken. Besides, the prothorax of the queen never differs in form from that of imago; while the nymphæ of the second form are distinguished by a broader prothorax. When in July the nymphæ of the second form begin to turn brown, as their last moulting was near at hand, in case they had to undergo one, their wing beginnings were still so small that it was impossible that out of them could become developed wings such as those animals possess which swarm in May. Even if they would get such wings, they would not be able to fly on account of their thick hinder bodies, as every one will agree who has seen living Termites.

The observations of Robe-Moreau, beginning in 1797 (his memoirs on the Termites observed by Rochefort, etc., appeared 1843), and who has given long years of observation to the Termites in and around Rochefort, met "delayed nymphæ" after the swarming time, which he supposed did not undergo a further change, as a second swarming had never been observed in Rochefort.

Dr. Hagen thinks that Robe-Moreau and Lespes have examined the same species, while Lespes believes that the *Termes lucifugus* of Bordeaux are different from those of Rochefort. However it may be, it seems to me there is scarcely a doubt that in Bordeaux there does not take place a second swarming of

males and females derived from the nymphæ of the second form. That rather these nymphæ remain wingless, and never leave their nests in which they develop themselves under conditions into males which can beget offspring, and into females which can lay eggs. These nymphæ, like mature animals, are already observed with several species, and have been usually described as queens. Joly illustrated a queen of *Termes lucifugus*, without wing-cases, and Lespes reports that Joly assured him also that the same had been seen without a trace of wing-cases. Besides, Burmeister described a female of *Termes flavipes* as a wingless queen, and Dr. Hagen, who examined the same animal, found it had about the same habit as a queen with the short wing-sheaths of a nympha. He also considers Bates' queen of *Termes arenarius* as a nympha with undeveloped wing-sheaths. (Communicated by letter of January 2nd, 1872.)

Further, I take here in consideration a specimen of *Calotermes flavicollis* which is in the British Museum, described by Walker among *Termes lucifugus*, a nympha with short wing-cases, deceptively like an imago which has lost the wings. The uniform black color, the shining polished head, thorax and body, exclude the idea of another moulting. (Dr. Hagen 12, pages 20 and 59, and at other places.) Therefore the males and females of certain species of Termites appear under two different forms.

The ones arising out of the nymphæ of the first form receive wings, and leave their birthplace in swarms. Only very few lucky ones among them are so successful as to ascend later a vacated throne as king and queen. The others, which have become the matured nymphæ of the second form, never see the light of day; they remain wingless, and never leave the nest in which they have grown.[4] Of what importance is now the preservation and the success of the species of each one of these two forms? A large

[4] Dr. Hagen writes me that all queens (of *Termes bellicosus*, *dives*, *obesui*, *gilvus*) which he saw, from Asia and Africa, are really imagines with the wing-stumps from which the wings are broken. On the contrary, all queens (of *Termes flavipes*, *morio*(?) *similis*(?) *arenarius*) which he had seen from Brazil and America were decidedly nymphæ. So striking this fact may seem, it would be hasty judgment to conclude from it that in the occurring of both forms there exists a difference between the old and new worlds. I have seen here more than a hundred real queens, more than Dr. Hagen, from Asia and Africa, before I found for the first time nympha-like females.

Termite colony sends out yearly over a hundred thousand winged males and females, for the purpose of receiving back a single royal pair every two, three, or four years.

The destruction made among these quite defenceless animals are numerous, from man to the common ant. As the difficulties are so great after the bride and groom have selected each other, and reached the nest for which a royal pair is wanted,—would it not seem more simple and more sure to keep all males and females well protected at home? What an amount of work would the Termites be spared if they did not have to bring up, year after year, those cloud-like swarms of winged animals which ascend from the large hill-nests.[6]

Is it not striking that with all species, wherever they may exist, a simpler and surer way has not been found which should spare so much work, by developing through nympha-like males and females, by the way of natural selection?

Whenever one meets such questions, one may usually take Darwin, and hope to find the key of the solution. In this way, whoever occupies himself with this subject will find recorded in the 17th chapter of his book on "The Variation of Animals and Plants under Domestication," evidence which he will scarcely object to acknowledge has made in the highest degree probable, if not proved, the conclusion with which Darwin closes the chapter: "That the crossing of animals and plants which are not closely related to each other is highly beneficial, or even necessary, and that inter-breeding prolonged during many generations is highly injurious."

Now with the majority of the Termite species of which sociable conditions are known, every colony possesses, with rare exceptions, a single royal pair, or sometimes a single king with two consorts. Therefore all in this state are grown-up males and females, brothers and sisters. The exclusive propagation through indigenous

[6] Rengger, Tollin, and others have spoken of the building up of new colonies by the swarming males and females, and reached the idea therefore that swarming would be absolutely necessary. I will not directly deny the ability of the males and females of Calotermes to go on living further in their own way, and to begin a new settlement. With all species of Termes, Eutermes, Anoplotermes, of which the way of living I know to some degree, a winged pair would undertake the foundation of a new state with exactly the same success as a pair of new-born children which one had set out on a desert island.

males and females would lead to the most narrow and limited marrying into the same family. During the out-swarming the males and females of different colonies can find each other, whose union here, as elsewhere, will produce a stronger offspring.

With the numerous exterminations, through diverse enemies, which the Termites undergo while swarming, it will occur that a colony is not able to fill its throne in due time with a new royal pair, in spite of their infinite number. In this case of need nympha-like males and females, safely kept in the nest, step in as substitutes, and save the colony from becoming extinguished.

From the circumstance, that only then these reserved males and females become necessary, if no real royal pair has been found after the close of the swarming time, the delayed developments of the nymphæ of the second form may be explained. Lespes reports that these nymphæ of the second form always become more rare the nearer the time of their changing approaches (only supposed, not observed). Dr. Hagen reports of the work of Lespes (12, page 317, and other places), that it would be certainly highly strange if the same really changed into winged animals for a second swarming.

It seems comprehensible that they are gradually allowed to die out by starvation when not needed, or that only so many are kept alive as are necessary. In a surprising way these conditions exist alike in the Termites as in the plants of the most different amilies, in the observed facts of closed blossoms (cleistogami Kuhn).[6]

As there develop on certain plants, besides open ones, the cross-fertilizing blossoms of different plants, so others are found developed which never open themselves (cleistogama), of which the stamens and pistils always remain enclosed, and by which the preservation of the species becomes assured in case the fructification depending on outside conditions does not take place through open blossoms.

In the same way certain Termite colonies develop beside the out-swarming and crossing of different colonies, through other

[6] Compare Hildebrand, The Distribution of Sexes in Plants, 1867, page 73. Severin Axell, Fanerogama Vaxternas Fructifij, 1869, pages 10 to 76.

never-swarming (cleistogamic) males and females, which always remain locked up in stock, and through which the preservation of the species becomes assured, in case the fructification of out-swarming males and females, depending on the favor of outside conditions, does not take place.

As the cleistogamic blossoms of many plants are to young buds of the opened blossoms, so are the cleistogamic males and females of the Termites alike in reproduction to the out-swarming. With the plants the leaves of the flowers remain, with the Termites the wings remain, in a lower state of development. The lavish production of flower-pollen in open flowers corresponds with the lavish production of winged males and females; as the limited number of nymphæ with short wing beginnings to the more scanty pollen of cleistogamic blossoms. As the cleistogamic blossoms of the violet unfold to open ones, so in *Termes lucifugus* the nymphæ of the second form develop later than those of the first form.

In the foreign *Leersia oryzoides* in France, fructification has been so far only observed to take place by means of cleistogamic blossoms, so until now in the garden in Schönbrun only one cleistogamic female has been found of the *Termes flavipes*, probably because in both cases, in a strange land, the outside conditions are not favorable for the usual fructification.

I had formed this opinion about the nymphæ with short wing-cases, the same as that in Dr. Hagen's monograph, from the facts there laid down, and stated in letters, long before I had the opportunity to see such animals.

Unfortunately the real kernel of this standpoint lacked the real foundation,—the proof failed,—that really cleistogamic males and females took charge of the transplanting of the species in cases where king and queen failed in stock.

One will comprehend with what joyful surprise I greeted a discovery which allows me now to furnish this proof.

I had (on the 11th of November) brought home with me the firm kernel (of a Eutermes nest), about the size of a hen's egg, out of decayed Gissara stump. Around the kernel were heaped considerable masses of eggs, and so I expected to find therein,

as usual, a royal pair. But instead of a large royal room enclosed in the middle part, the whole kernel was as a sponge, with irregular ways leading all through it. In these passages sat here and there not less than thirty-one compensating females,—five or six pressed tight together, with short wing beginnings (Fig. 1); six or eight mm. long. Among them only a single king walked around, of nearly the same size, and indeed an actual king, with large black eyes, and the wings were broken off from the wing-scales.

A queen was lacking.

Instead of a royal palace in which a king lived in chaste matrimony with his equal consort, I had a harem before my eyes, in which a sultan satisfied himself with numerous coquettes.[7]

In course of a day these supplementary females laid a pretty large number of eggs, which were carried into little heaps by the workers. The same wave-like contractions, as with the queens, could be seen, and I saw with several the extrusion of an egg.

The color of these females with short wing beginnings is a light brown, by which they are distinguished, as much from the pale, nearly colorless workers, as from the great deal darker-colored king. As a whole they look pretty much like the workers, more alike than to any other forms of their kind, only they are twice as large. Their wing beginnings are with most of them too small to be noticed, by a not very careful observation. Their hinder body, only slightly swollen, has about the same oviform figure, and stands about in the same relation to the whole length as that of the worker. The likeness of the head (Fig. 2)

[7] It may be supposed that Bofinet had already seen a similar company of supplementary females of *Termes lucifugus*. There were seven of them in the middle of a beam or joist. They were eight by ten mm. long, nearly white or very light red. Near them were found several egg heaps and very numerous larvæ, enough therewith to fill a litre. Compare Dr. Hagen's report (10, page 130, and other places).

Lespes had found in *Termes lucifugus* only a single royal pair, and the bright color of those found by Bofinet is not characteristic of the real queens.

When Dr. Hagen (12, page 177, and other places) supposed that Lespes might have seen no queens at all, but only large nymphæ of the second form, contradicting the assurance of Lespes (page 332, and at other places), expressly accentuated by Joly, that the wing-scales of his queens were always present. In the different measurements by Bofinet, Joly, and Lespes I can find no objection, as the females only grow up gradually from that of the imago to the fabulous size which has made the queens of the Termites so celebrated, and one can find all the sizes that lie between.

is especially striking. The clear cross lines which generally distinguish the head of the Eutermes worker are with most of these females scarcely less distinct than with the workers. (Hagen 12, page 187, and at other places). The antennæ have fourteen joints, as those of the worker, while the soldiers have but thirteen, and the winged animals have fifteen. The head could be taken for that of a worker if it were not for their little round faceted eyes, which, however, are scarcely raised above their surroundings, and are somewhat a slightly darker color.

I have not observed ocelli. The prothorax resembles that of the worker—it has a saddle-formed depression, going cross-wise, which separates a forward flap, and this flap is very large with the worker, steep, turned upwards, and not deeply carved in the middle of its front edge. With the supplementary females it is only small, and was simply rounded off, and goes up slightly. The size of the forward lap changes, however, with some few samples, and it was reproduced by a small seam, and then the prothorax resembled that of the king. The wing beginnings take the whole lateral borders of the meso- and meta-thorax (Pl. XXXIV., A); mostly they are scarcely half so long as these body wings, broad and then triangular, horizontal to the outside directed projections of which the forward edge goes obliquely to the background; with very few samples (Pl. XXXIV., B) the wing beginnings are considerably longer; also the meso- and meta-thorax are in this case a great deal more strongly developed. The oblique to reverted wing beginnings cover the forward edge of the hinder ones. The belly shields are formed as with the winged females. The internal reproductive organs (Fig. 3) are nearly like those of the winged females, for the reason that they hold eggs. Every ovary seems to have about half a dozen, and the egg-tubes about a dozen, for every ovary (the number seems to be rather variable), and are placed in clusters, as with the winged females, on the end of a short oviduct, while with the full-grown queen every ovary forms a long tube, that in the whole length is covered thickly with extraordinary numbers of egg-tubes. The seed pocket and albumen glands have the usual

form. A queen 19 mm. long, which weighed about 0.2 grammes, is equal in weight to fifteen supplementary females. The ovaries of all the thirty-one supplementary females may together scarcely weigh as much, and furnish hardly as many eggs, as those of a single older queen.

Lespes and Dr. Hagen also found male nymphæ with short wing beginnings, so the king may probably just as well be substituted by supplementary males as the queen by supplementary females. Does such a substitution take place in a nest at the same time for both sexes? out of those eggs of the supplementary females fertilized by the supplementary males develop all forms which compose the Termite population? or are only workers and soldiers; and are, of all species, in all colonies, regularly each year, nymphæ with short wing beginnings produced?

These are questions which I cannot answer now with certainty. The exact solution may require observations continued for years.

Supplement.—Bates, Lespes, and also myself found the youngest larvæ of the different classes occurring in the Termite family undistinguishable.

Before they reach half the length of the grown-up worker, they separate themselves by the first indication of the wing-cases.

From the larvæ of the later, able to become reproducing animals, those of the soldiers and workers are distinguished by their thicker heads, as also in *Termes saliens* and others.

Only a short time before the last moulting are the larvæ of the soldiers distinguishable from those of the workers, however different both may be in grown-up condition. A single exception only has been observed by Bonifit of a soldier which was so small that it as such seemed to have left the egg.

If the difference in sexes is not taken into consideration, that of the two-fold forms of the workers and soldiers which seems to occur with some species, may be expressed in the following statement which is made for the Termite states (or colonies) of the species Termes and Eutermes.

PLATE XXXIV.

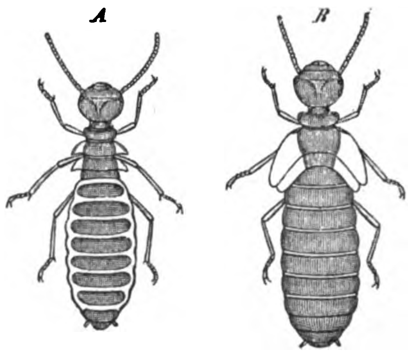


Fig. 1.

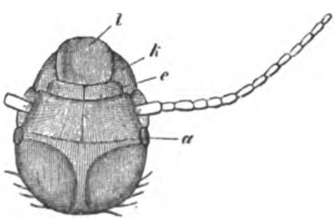


Fig. 2.

Fig. 3.

Termes lucifugus.

TABLE OF DEVELOPMENT.

No. 1. Youngest Larvæ.

- 2. Larvæ of classes not able to reproduce.
  - 4. Larvæ of Soldiers.
    - 6. Soldiers.
  - 5. Larvæ of Workers.
    - 7. Workers.
- 3. Larvæ of classes able to reproduce.
  - 8. Nymphæ of the first form.
    - 10. Winged Animals.
      - 11. King and Queen.
  - 9. Nymphæ of the second form.
    - 12. Supplementary Males and Females.

DESCRIPTION OF PLATE XXXIV.

FIG. 1.—Two compensating females of *Termes lucifugus*. *A*, The usual form, with short wing beginnings; *B*, the more uncommon form, with longer wing beginnings.

FIG. 2.—Head of a compensating (or supplementary) female. *a*, Both small faceted eyes; *l*, the upper lip; *k*, the upper jaw.

FIG. 3.—Sexual parts of a compensating (or supplementary) female; *s*, semen pocket; *k*, albumen glands.

STUDIES OF PELECYPODA.

BY ROBERT TRACY JACKSON.

THIS paper is a brief summary of some of the more important and interesting facts and conclusions contained in a paper recently published by the author.[1] The leading principles employed in the paper are two: I. Professors Cope's and Hyatt's theory of the acceleration of development, with its corollary that in the young, stages are found, the equivalents of which are to be sought in the adults of ancestral groups. II. That in the mechanical conditions of environment and a study of the life-habits of animals, facts may be gathered which will throw light on the origin and meaning of external and internal anatomical features.[2] In accordance with the above principles, young and adults, living and fossil species of many allied genera were taken up as one common study.

The completed embryonic shell of Pelecypods differs from and is commonly sharply marked off from the succeeding shell growth. This embryonic shell is compared to the protoconch of cephalous molluscs, and as it is bivalved it is termed a prodissoconch. Carrying out the same terminology, the succeeding shell growth is termed a dissoconch. In my paper a prodissoconch is described, or at least mentioned, as existing in thirty-nine genera of Pelecypods.

Prof. Hyatt's classification of stages of growth and decline[3] is considered at length in its application to the Mollusca. Some alterations in that valuable classification were deemed necessary, and are introduced.

[1] Phylogeny of the Pelecypoda, the Aviculidæ, and Their Allies. Mem. Bost. Soc. Nat. Hist., Vol. IV., No. 8, July, 1890, pp. 277–400, Pls. XXIII.–XXX.

[2] In a paper soon to be published in this journal, I consider some cases of the mechanical origin of structures in Pelecypods.

[3] See this journal for October, 1888.

The development of the oyster is followed from the egg up to the adult. It is a highly modified Pelecypod, and has a very accelerated development. The completed prodissoconch stage of Ostrea (Fig. 1) is an important period in development, and yields facts of much phylogenetic significance. Two adductor muscles exist instead of one, as in earlier and later stages. No foot, but filamentous gills, a velum, and a plain mantle border exist. The anus overlies the posterior adductor muscle, and the velum and mouth lie on the ventral border of the anterior adductor, the normal condition in dimyarian Pelecypods. The larval umbos are directed posteriorly, —a fact of some significance. In all Pelecypods apparently, as in Ostrea, the anterior adductor is developed first, both muscles always being present, as far as known, at the completed prodissoconch stage.

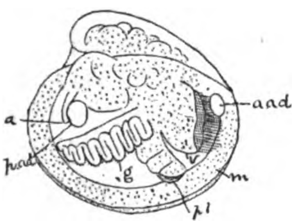


FIG. 1.—*Ostrea virginiana*; *a ad*, *p ad*, anterior and posterior adductor muscles; *g*, gills; *v*, velum; *pl*, palps; *a*, anus; *m*, mantle border. X 90 diam.

In the nepionic stages, which succeed the prodissoconch, changes take place rapidly. Fig. 2 is the same specimen as Fig. 1, but three days older. The anterior adductor muscle has disappeared, and the gill filaments are connected ventrally by cross-connecting bars. Later the antero-posterior axis becomes revolved, so that the mouth parts are directed toward the hinge line. An intricate system of cross-connecting bars is built up between the gill filaments, until we find the condition characteristic of the adult. Whereas but a single pair of gills exists in early stages, later two new gills originate, one on the outer side of each previously formed gill. The new gills do not originate simultaneously, but there is a considerable interval, which forms a three-gilled period.

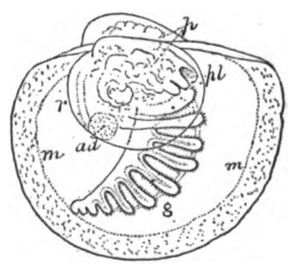


FIG. 2.—*Ostrea virginiana*; *pl*, palps; *ad*, adductor muscle; *r*, rectum; *g*, gills; *m*, mantle border; *p*, prodissoconch.

There are four distinct periods in the development of the shell of Ostrea: I. The phylembryo[4] stage, with saucer-shaped valves, a straight hinge line, and but slightly developed umbos. II. The completed prodissoconch (Fig. 3), with a curved hinge line, well-developed umbos, nearly equal valves, and without prismatic cellular structure. In *Ostrea edulis* there are teeth similar to those of Nucula on the hinge line of the prodissoconch, but none exist in *O. virginiana*. III. The nepionic period (Fig. 4), with a flat attached and convex free valve. The triangular cartilage pit of Ostrea originates in the initial nepionic stages on the border of the prodissoconch valve (Fig. 5). The right valve of this period has a well-defined prismatic layer. IV. The adult, in which the attached valve is concave and the free valve is flat.

FIG. 3.—Prodissoconch stages of *Ostrea virginiana*; *l*, left, and *r* right valve.

In the Ostreidæ[5] the striking peculiarity of the shell is that the valves are unequal, and also dissimilar. This character is ascribed to the mechanical effects of the condition of cemented

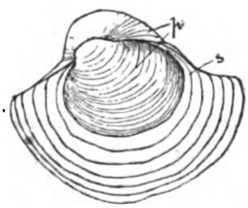


FIG. 4.—*Ostrea virginiana*; *p*, prodissoconch; *s*, spat or nepionic growth.

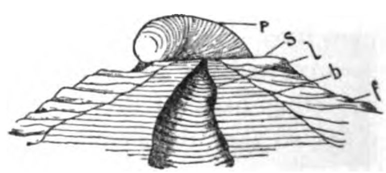


FIG. 5.—*Ostrea virginiana*; tip of left valve; *p*, prodissoconch; *s*, spat or nepionic growth; *l*, cartilage pit; *b*, flange-like extension of shell over object of support.

fixation acting on a Pelecypod shell. This conclusion is of great value in tracing the genetic relations of attached forms. Differences in the two valves of attached forms may be seen in Spondylus, Hinnites, Mulleria, the Chamidæ, Rudistæ, etc. There is abundant proof that the form is due to the condition of fixation, and not to gravity, as has been maintained. The form induced

[4] A new term, designating an early embryonic stage, yet which is advanced enough to show the characteristics of the class or phylum to which the embryo belongs.

[5] In my paper it is spelled Ostreadæ. In deference to rule, as a family name it should have been spelled as above. See Proc. Am. Ass. Adv. Sc., Aug., 1877.

by cemented fixation is a concave attached valve, a flatter and commonly thinner free valve, an irregularity and assymmetry of growth tending to the displacement of characters normally found in near allies, and, as a general thing, a camerated structure of the shell. The fullest modification in this line of variation is the production of a shell in which the attached valve is cup-shaped, conical, or subcylindrical, as seen in the Chamidæ and Rudistæ. In this group as a whole, and in the progressive stages of growth of its extremest members, all transitions may be followed between a simple ostreiform or exogyriform shell and the most highly modified conical type. The Ostrea form is the first step in this line of variation, the Exogyra form is the second step, and the Hippurite form is the last step. The equal impact of moving water on all sides of the attached organism is believed to be the chief factor in inducing this form, but aided by correlated forces as briefly discussed in my paper.

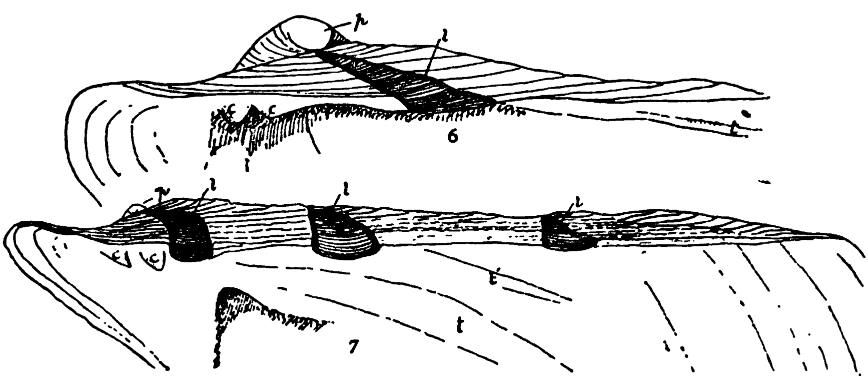


FIG. 6.—Young *Perna ephippium*, right valve; *p*, prodissoconch; *l*, cartilage pit; *c*, cardinal, and *t*, lateral, teeth. X 90 diam.

FIG. 7.—*Perna ephippium*, older than Fig. 6, with several cartilage pits; lettering as above. X 24 diam.

It is considered that Ostrea probably descended from Perna, or a close common ancestor of the two genera. The bases of likeness are the anatomy of the soft parts, shell structure, the prodissoconch, and other features in the development of both genera. The differences are mainly ascribed to the effects of the condition of fixation in Ostrea.

Perna has a prodissoconch closely like that of Ostrea. The byssal sinus originates in the initial stages of dissoconch growth. In young Perna (Fig. 6) a single triangular cartilage pit exists as in Ostrea. In later growth new pits originate on the ligamental line (Fig. 7). They, too, are triangular at first, but when the sides of the triangles have attained a certain degree of divergence they are produced perpendicularly, which is the condition found in the adult. The nepionic stage of Perna (Fig. 8) is subrhombic in form, and the anterior auricle descends directly from the limits of the prodissoconch. The form of this stage is comparable to that found in early Paleozoic Aviculoids. It is compared to *Rhombopteria glabra* sp. Barr., from the Silurian.

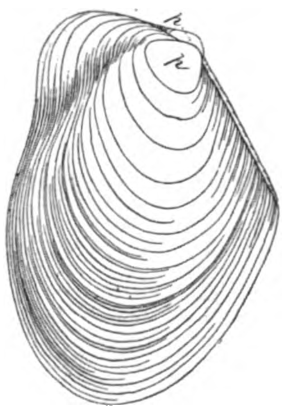


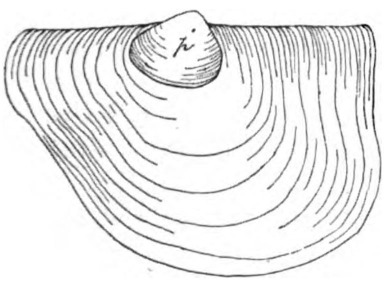
FIG. 8.—Young *Perna ephippium*; *p*, prodissoconch. X about 37 diam.

In Avicula we find a prodissoconch like that of Perna and Ostrea, and, as in those genera, it is traceable in origin to the nuculoid radical which forms the basis of our genealogical table. The nepionic stage of Avicula (Fig. 9) is subrhombic in form, and is referable in origin to early Aviculoids. It is compared to *Rhombopteria mira* (Fig. 16), from the Silurian. A later stage of Avicula (Fig. 10) differs from the nepionic and adult periods, and is comparable to the Devonian genus Leptodesma, which is the third step up in the phylogeny of the Avicula series.

A prodissoconch and nepionic stage similar to those of Avicula are described in many allied genera, which are Meleagrina, Monotis, Pseudomonotis, Oxytoma, Cassianella, and Vulsella.

Pecten irradians presents an interesting subject for study. Its life-habits are varied and striking. Its stages in growth, both in the soft parts and the hard, present a remarkable series of high phylogenetic significance. At the completed prodissoconch stage Pecten is doubtless dimyarian, and crawls on the ventral border of the valves by means of an active foot. It may also have a

velum at that stage, and be capable of swimming by means of that organ. In the nepionic stage the foot is of relatively great size, mobile and prehensile. It extends through a special notch in the right valve (Fig. 12), this being the side on which the foot exerts pressure in the act of crawling. This notch is a necessary mechanical consequence of the conditions of the case. At a later stage in Pecten, we find that the early free crawling condition is abandoned, and the animal adopts the habit of byssal fixation, which is more or less adhered to until the animal is two to three centimetres in height; but was not observed in adult *Pecten irradians.*[6] Although the swimming habit of *Pecten irradians* is



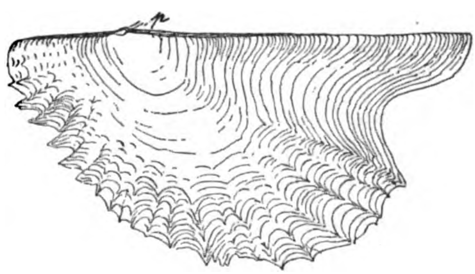


FIG. 9.—Young *Avicula sterna*, umbonal area of valve, showing (*p*) prodissoconch and succeeding nepionic growth.

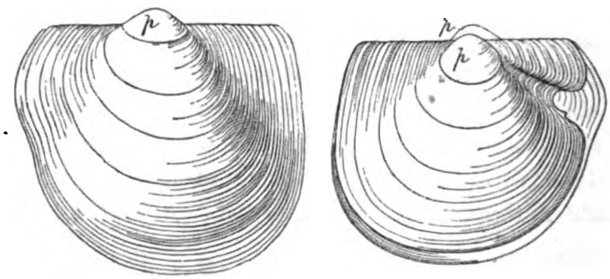
FIG. 10.—Young *Avicula sterna*, showing later stage of growth.

more or less exercised from the nepionic stages up, it is essentially the life-habit of the adult, for then the crawling and byssal habits are abandoned and the foot is atrophied. The swimming of Pecten is most active, and in the anatomy we find a most perfect adaptation of parts to the requirements of this peculiar habit.

In the shell of Pecten (Figs. 11, 12) the prodissoconch is sharply defined, as in the genera already mentioned. It is directly referable in shell structure and in the inferred soft parts to to the nuculoid radical of the group. The nepionic stage (Figs. 11, 12), is subrhombic in form, has no ears, and is a very striking period of growth. The right valve has a byssal sinus which originates with the nepionic stage as in Perna and Avicula, and a tooth exists on the margin of the notch. This stage is closely

[6] I recently dredged near Eastport, Me., adult specimens of *Chlamys islandica* which were attached by a byssus.

like the same stage of Perna (Fig 8) and Avicula (Fig. 9), and is traceable in origin to the same ancestral type, Rhombopteria (Fig. 16). The right valve of this stage of Pecten possesses a well-defined layer of prismatic tissue, though it is early lost.



FIGS. 11, 12.—Young *Pecten irradians*, viewed from the left and right sides; *p*, prodissoconch. X about 37 diam.

This is a good example of accelerated development, for prismatic tissue is characteristic of the adults of the Aviculidæ, from which group the Pectinidæ were derived.

In a later stage of growth of Pecten (Fig. 13) we find im-

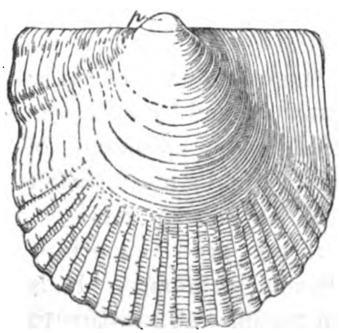


FIG. 13.—Young *Pecten irradians; p*, prodissoconch. X 30 diam.

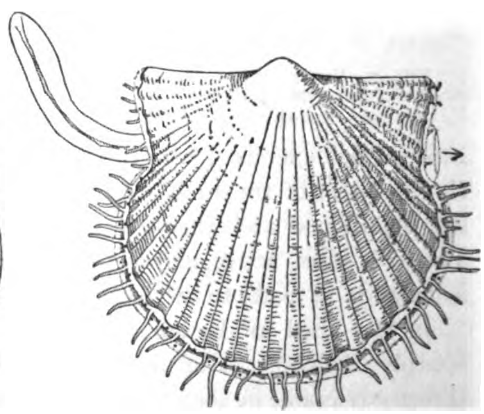


FIG. 14.—*Pecten irradians*, still older; showing foot, tentacles, eyes, and excurrent pseudosiphon. X 12 diam.

portant changes in form, which mark the beginning of features characteristic of the family. The hinge line is longer and terminated by slightly developed ears, plications originate in both valves, and the byssal notch is strongly marked. This stage is referable

in origin to Pterinopecten, a Devonian genus which is adopted as the base of the family of the Pectinidæ. At a still later stage (Fig. 14), the hinge line is relatively shorter than in Fig. 13, yet longer than in the adult. The ears are well pronounced. This stage is comparable to Aviculopecten (as amended by Prof. James Hall), which is the second step in the Pecten series.

Similar stages to those described in *Pecten irradians* have been observed in several other species. In the young of *Pecten magellanicus* there is ornamentation of the shell strikingly like that seen frequently in Aviculopecten.

Hinnites is pecteniform in its nealogic stage, and shows graphically the change in form induced when it becomes attached and assumes the ostrean features characteristic of the adult. Spondylus has a prodissoconch like Pecten, and in its nepionic stage is pecteniform as observed in five species, proving its origin in that group. It early becomes attached and assumes the ostrean form. Plicatula becomes attached at the close of the prodissoconch stage, and at once assumes the ostrean form; thus as in Ostrea nepionic characters are eradicated which might, if existent, show distinct phylogenetic stages. It is the furthest removed from Pecten of its series, because it earliest and most completely assumes the ostrean form.

In Anomia the form of shell and peculiarities in the soft parts may fairly be ascribed to adaptation to the environment, rather than to genetic connections of the group. In the early nepionic stage Anomia is freely locomotive, with a highly active foot. At this age byssal attachment is voluntary, and is frequently abandoned. The relations of the muscles, which are ambiguous in the adult, are clear in the young. The calcareous plug is composed of consolidated parallel ridges of lime. In the young these ridges are seen to be made up by the amalgamation of calcareous discoid points. The several points are directly comparable to the discoid points of fixation of the byssal threads in Pecten, Mytilus, etc. The prodissoconch of Anomia is described in two species. It differs from the prodissoconch of the previously mentioned genera in possessing a slight byssal sinus in one or both valves, according to the species, thus showing a very accelerated develop-

ment. During the nepionic stage the byssus becomes enclosed by progressive deepening of the byssal sinus and circular growth of the right valve. In later growth extensive resorption of the shell progressively enlarges the byssal foramen. The right valve of *Anomia glabra* is thinner than the left valve, and differs also in being almost entirely composed of prismatic tissue.

In the section "Studies of a Few Other Genera" the young of Pelecypods more or less remotely separated from the Aviculidæ are considered. In these genera the umbos of the prodissoconch are directed anteriorly relatively to the larval anatomy, excepting in Nucula, Tellina, and the Unionidæ, in which last group umbos are not developed. In all genera excepting the Unionidæ the nepionic stage does not have a prismatic layer. In genera of the Aviculidæ and allies, on the contrary, we find the umbos of the prodissoconch are directed posteriorly relatively to the larval anatomy (Fig. 1), and the nepionic stage has a layer of prismatic tissue, although this may disappear in later growth.

In genera of the Mytilidæ and Arcidæ we find a well-defined prodissoconch and nepionic stages, which are traceable to ancient fossil representatives of the families. In three genera of the Unionidæ studied the completed prodissoconch is of the same size and form as the glochidial stage. In structure it has not progressed beyond a modified condition of the phylembryonic stage. It is a specialized type, owing its peculiarities apparently to parasitism and correlated larval adaptation. A prodissoconch and nepionic stages are described in Echinochama, Sphærium, Petricola, Venus, Tottenia, Scrobicularia, and Saxicava. The prodissoconch is mentioned without description in a few other genera. In *Mya arenaria* a considerable description is given of the byssal habit, development of the siphon, and the shell. These present features of phylogenetic interest.

In the development of the shell of Pelecypods the phylembryonic stage has a straight hinge line, which apparently represents a primitive condition common to the whole class. This form appears to be the natural mechanical outcome of its derivation from a primitive univalvular ancestral type. The next step in the development of the Pelecypod shell is the curving of the

hinge line, the centralization of connecting tissue and teeth in the middle of the hinge line, and the development of umbos.

The characters described in the prodissoconch of the Aviculidæ and their allies are found combined in a remarkable degree in the ancient genus Nucula, which, though living to-day, extends back to early Paleozoic formations. It is probable that Nucula, or a nuculoid form, is the type we are seeking as the ancestral radical represented by the completed prodissoconch in the development of Avicula, Perna, Ostrea, Pecten, and their allies. The fact that Nucula is found in the Lower Silurian, and still lives without sufficient changes in form to make these extremely separable forms in time generically separable, argues for a high antiquity for this genus. It was so firmly established in its earliest-known forms, it must at that time have been an ancient genus.

The nepionic stages of Avicula, Perna, and Pecten (Figs. 8, 9, and 11) agree closely in form, and are referable to an early, simple aviculoid type, Rhombopteria (Fig. 16). Therefore, that genus is adopted as the basis of the Aviculidæ, being the first step up from the nuculoid radical of the group. From Rhombopteria, Leptodesma leads up to Avicula, forming the central stock of the family. From the Avicula stock many side issues arise, as Meleagrina, Pseudomonotis, Cassianella, Malleus, and others. These are like Avicula (Fig. 9) in the nepionic stage, but in later growth depart from the typical form of the stock. Perna is an important issue from Avicula, which it resembles in the nepionic stage. Gervillia and the Inoceramus group are modified forms from the Perna stock. The Ostreidæ are considered a modified branch from the Perna stock, which owes its peculiar features chiefly to the effects of fixation. Ostrea is the base of its group, and Exogyra the extreme, because it is the most highly modified by the adopted habit of attachment.

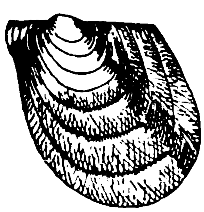


FIG. 16.—*Rhombopteria*[1] *mira* sp. Barr. Upper Silurian (after Barrande).

[1] A new genus, proposed in my paper for an ancient simple group of aviculoid shells.

From Leptodesma-like forms the Pinnidæ are probably derived. This is considered a degradational group on account of the high development of the anterior adductor (a larval character), prismatic structure, and other peculiarities of some members. The Pterinea group is considered a side issue from the Rhombopteria stock. Pterinopecten is an important branch from the Rhombopteria stock. In the young it closely resembles Rhombopteria. It forms the base of the Pecten series. Aviculopecten is the next ascendant step in the Pecten series. In stages of growth it resembles, first, Rhombopteria; second, Pterinopecten. Pecten, the representative of the family, is the summit of the stock. As we have shown, the prodissoconch resembles the nuculoid radical. The first nepionic stage resembles Rhombopteria; the second and third nepionic stages, resemble respectively Pterinopecten and Aviculopecten. Lyriopecten and Crenipecten are considered side issues from Aviculopecten. From the Pecten stock important issues are given off. These are the Hinnites, Lima, Amusium, Anomia, and Dimya groups.

The phylogenetic relations of the Aviculidæ and allies are considered in more or less detail in the last section of my paper, which is closed by a tabular view representing graphically the various genetic relations expressed.

ANNELID DESCENT: THE ORIGIN OF METAMERISM AND THE SIGNIFICANCE OF THE MESODERM.[1]

BY EDUARD MEYER.

THE recent publication by Claus of a paper "On the Morphological and Phylogenetic Significance of the Body of the Tapeworm"[2] has induced me to defer no longer the long-entertained and elaborated conception of the origin of metamerism amongst Annelids, and thus amongst all segmented Bilateralia, but to communicate to my fellow-workers, provisionally at least, a general sketch of it.

Claus, in the paper quoted above, refuting the conception of the tapeworm as a colony due to strobilation, brings forward evidence that the segmented Cestode body is to be derived from a non-segmented form in which, at first, the internal organs (sexual organs) appeared in metameric sequence, and later a corresponding external segmentation was introduced. This has finally attained a maximum in the superlative individualization of pieces of the body that separate completely from it in the formation of proglottids.

In my opinion, the Annelids owe the metamerism of their bodies to a process quite analogous, which here has produced a certain, but never, indeed, a complete, individualization of the segment, and which in some cases has finally degenerated into a non-sexual reproduction by fission.

This last phenomenon, in which I can see, when occurring in the higher Metazoa, a considerable degree of degradation, is often used as an argument in favor of their hypothesis by the supporters of the doctrine that animal segmentation had its origin in budding. We should not forget, however, that reproduction by fission among the Annelids has either been observed in only such forms as have a structure implying undoubtedly not primary but degen-

[1] Translated by Dr. E. A. Andrews from the *Biologisches Centralblatt*, X., July, 1890.

[2] Arbeit. a. d. zool. Inst. Wien, VIII., 1889.

erate simplicity of structure, or (where it occurs in the less simple members of the class) appears as the almost mechanical separation of part of the body, tending to destroy the general equilibrium by the collection of sexual products. The formation of a new head in this process can only be regarded as a phenomenon of regeneration that has been thrown back into earlier periods in consequence of the regular repetition of the process of fission from generation to generation, and that finally begins in a period when the separating part is still connected with the parent.

Moreover, if metamerism in segmented animals had originally arisen from the formation of buds, then, in the first place, the production of new segments must always take place at the extreme end of the body, or, in other words, the terminal section should be always the most recently formed metamere; and, in the second place, the entire body must consist of completely equivalent, consecutive pieces. In place of this we see, however, that the new segments arise from a formative zone anterior to the telson, that the telson belongs to the oldest part of the animal, and that all parts of the body do not correspond, since neither the cephalic lobe with the buccal zone and foregut, nor the terminal piece with the hindgut, can be compared with the metameres lying between them. If we derive the origin of metamerism from the kind of strobilation found in Acalephs, then the youngest segments follow immediately upon the first body segment, which (though occurring in the segmented Cestodes) is not at all the case in all other segmented animals from the Annelids up.

The heteronomy of prostomium, trunk segments, and telson, becomes intelligible, nay necessary, when we regard the metameres as arising from the segmentation of the trunk between the head and tail pieces,—that is, as arising in situ. How may this process have been effected in phylogeny?

The acquisitions of recent years indicate with considerable certainty that all segmented animals, omitting the Cestodes, have descended directly or indirectly from Annelids, and thus in them or in their immediate ancestors the formation of metameres had its origin. As long as these ancestors are regarded as trochospheres or medusa-like creatures (Hatschek, Kleinenberg), or if the Anne-

lids are regarded as descended from Echinoderms, as has been done (R. Wagner), we can scarcely come nearer to the solution of the above question, since we are driven to resort either to budding, strobilation, or to circumlocutions, such as "intermittently progressive processes of growth and differentiation." We will, I believe, arrive much sooner at the goal if we derive the Annelids from Planarian-like ancestors, for which the development, especially the differentation of the mesoderm, gives ample ground.

We find in Annelids, typically, as a chief constituent of the mesoderm, the two mesoderm-bands growing forward from two pole-cells. These bands, at first solid strands, subsequently break up, in the trunk, into the paired mesodermic somites, which become hollowed out and give rise to the definitive body-cavity; this constitutes the so-called secondary mesoderm. Besides this, larvæ as well as embryos of Annelids have a "primary" mesoderm, which not only functions in the larva before the formation of the mesoderm-bands, but also furnishes a considerable part of the permanent organs. To the former category belong the various simple muscles and the excretory organs of the larva; to the latter also a number of muscles, namely, the circular muscles, the transverse muscles, the muscles of the setæ sacs, septa, and mesenteries, the special muscles of the various parts of the digestive tract, also the retro-peritoneal connective tissue whenever it is formed, and in certain cases the excretory part of the definitive nephridia, which I have called the nephridial tube. Such a state of things I have established as existing in various Polychæte larvæ, and the same may be inferred with tolerable certainty from many statements in the literature, though the interpretations there are manifoldly different. The distinction between the *primary mesoderm*, or *embryonic mesenchym*, as it might be better called, and the *secondary* or *cœlomic mesoderm*, appears most plainly when a spacious primary body-cavity occurs between the ectoderm and the entoderm, separating the parietal mesenchym next the skin from the mesoderm-band next the digestive tract. As an example of this I would cite the larva of Psygmobranchus.[3]

[3] See Pls. 23 and 24 in Mitth. Zool. Station Neapel, VIII., 1888. I have there called the element of the primary mesoderm "parenchyma," from consideration of the possible reference to the corresponding tissue of the Turbellarians. As, however, this designation carries with it the idea of a more compact tissue, it is thus not quite a fitting one, and so I return to the old name, "mesenchym."

At the period when the mesoderm-bands are dividing into segments the mesenchym elements have so far increased throughout the entire trunk as to fill out completely the space between ectoderm and entoderm, not occupied by those bands. At the same time a portion (subsequently the septal and mesenterial muscles) penetrates between the mesodermal segments, thus leading to the division of the mesoderm-bands. This fact is also to be observed, that the external follows the internal segmentation of the body. At this stage in development, the similarity between the mesodermal structures of the young Annelid and those of an adult Turbellarian cannot be doubted. In the latter, as in the former, we find between the skin and the intestine cell aggregates, either solid or becoming hollowed out; in the latter the sexual organs, in the former the mesoderm somites (while in both the head region remains free from such structures).[4] The structures in Annelids and Turbellarians here compared are, in my opinion, really genetically connected. All the mesenchym structures in the Annelid, both in larval and adult stages, may be compared with quite similar structures in the parenchyma of the Turbellarian; the paired, metameric, peritoneal sacs, arising from the mesoderm somites, enclosing the body-cavity and producing the sexual products in definite areas, may be regarded as sexual follicles, with much enlarged cavities and manifoldly differentiated walls.[5]

In place of a more detailed demonstration, I will here give a preliminary sketch of my views on the phylogenetic development of the Annelid, such as I gave at the last (eighth) Congress of Naturalists, at St. Petersburg, January, 1890.

[4] In the Annelid the cephalic lobe does not possess any mesoderm segment of its own, but, as I have repeatedly convinced myself, receives its peritoneal lining from the growth of the walls of the first post-oral pair of somites,—that is, the first pair of the trunk. In this process the primitive head-cavity is completely obliterated.

[5] After Hatschek had expressed the idea that "the secondary body-cavity is comparable to the cavity of the sexual glands in lower forms," R. S. Berg endeavored to derive the peritoneal segment cavities of Annelids from the sexual follicles of the Nemerteans, but soon completely renounced this "working hypothesis" in favor of Kleinenberg's recent interpretation of the mesoderm. I had conceived, in the main, the views here presented before the publication of this opinion of Berg's, and have as yet learned no valid reason for changing my mind.

I imagine the ancestors of Annelids to have been powerful, predatory Turbellarians, which lived a pelagic life, and were at that time masters of the seas. By their agility in swimming and in catching their prey these forms were distinguished from their present non-parasitic relatives, the Planarians; and only such acquirements could, in my opinion, have led to a perfection of organization in an ascending direction. The Planarians were forced to the sea bottom to take refuge amongst rocks and plants, first by these ancestors, then by their favored younger relatives, the Annelids, and finally by fish and other predatory marine animals. Here they led a creeping life, and thence gradually acquired a flat, broad body, with irregular arrangement of the internal organs. The ancestors had an elongated body, rounded in section and very supple; so that these may have borne a resemblance to the Nemerteans. Yet the Annelids cannot be derived from these worms, since they undoubtedly form a side branch, subsequently much changed and distinguished by peculiar characters (proboscis, vascular system, excretory organs). Yet these have preserved some of the internal organization derived from those common pelagic ancestors, which may give us very valuable hints in considering the Annelid body.

In the body parenchyma, partly surrounded by, partly penetrated by powerful muscle systems, were the sexual glands, appearing originally in the immature state as a single pair of compact cell-bands, but in the mature condition as long, hollow tubes, opening externally at the posterior end of the body by a pair of simple dermal pores. It is conceivable that these organs, being distended with eggs or sperm at certain times, would much interfere with the flexibility of the entire body. Now, however, in consequence of this very rigidity produced by the excessive accumulation of sexual products, they would finally yield to the constantly repeated endeavors of the animal to regain its accustomed mobility, and divide up into smaller glands. Thus it would have been the serpentine swimming motions (by which alone we can imagine the rapid change of place of a long worm in the water) of the Turbellarian-like ancestors of the Annelids which caused the disintegration of the two originally uniform, elonga-

ted genital tubes into two rows of equal segments. In this process, very probably, certain muscular regions, especially those parts of the transverse and dorso-ventral systems serving in that mode of motion, took active part during their contraction by continually constricting the undivided genital glands.

The series of successive sexual glands thus arising, and arranged symmetrically on both sides of the intestinal canal for the maintenance of equilibrium, now furnished internal metameric centres, about which the remaining organs, which were previously diffusely distributed in and on the body, also grouped themselves metamerically. This I regard as having taken place as follows: In the gradual increase of thickness and firmness of the skin, or perhaps merely from the secretion of a cuticula of little elasticity; and again in consequence of serpentine swimming movements, circular furrows were formed upon the surface, where the integument was thinner. The sexual follicles, swelling at maturity, and so distending the body at equal intervals, would predetermine definite places for occurrence of these furrows,—that is, between two successive pairs of sexual glands. In the segmented body-zones thus marked out each somewhat centrally placed pair of the remaining organs acquired greater perfection, and thus rendered all its homologues superfluous in its segment, so that these gradually underwent complete degeneration. This, in my opinion, was the origin of metamerism.[6]

The cavities of the parenchyma probably first united into a large sinus about the intestine, from which lymph penetrated into the interior of the paired metameric sexual glands to nourish the developing sexual products floating in them. As this increased in quantity the follicular cavities expanded more and more, and in this way became transformed into the secondary body-cavity with its paired, segmentally arranged chambers. In the epithelial walls only certain areas, subsequently the sexual glands proper

[6] While writing this the recent "Lehrbuch der vergleichenden Entwicklungsgeschichte der Wirbellosen Tiere" of E. Korschelt and K. Heider came into my hands, and in it also the idea is advanced that "by terminal growth first an elongated, non-segmented ancestral form was reached, and then the entire body divided up simultaneously into a large number of segments by a rearrangement of the separate organs." In their opinion, also, the "serpentine motions" gave rise to such a process, since they must have led to the formation in the body of "alternating regions of greater and less mobility."

of the Annelid, retained the ability to produce egg or sperm mother cells; while the remainder, at first a sort of indifferent follicular epithelium, was pressed against the internal organs and tissues, and finally surrounded them in the form of a peritoneum. In this process the hæmal and neural mesenteries and the septa came into existence, as the previously existing dorso-ventral parenchym muscles became enclosed between the median walls of a pair of segmental cavities, and between the anterior and posterior walls of two successive ones.

The greater part of the primary body-cavity, consisting in the ancestral forms presumably of a lymph system of irregular holes and clefts in the parenchyma, was filled up for the most part by the expansion of the sexual follicles. Only a small part of it remained as the definitive vascular system. Since the cœlom sacs at first were rounded, they would not apply their walls immediately to the entire surface of the intestine, skin and to one another, but would leave open certain definite spaces,—namely, intersegmental circular spaces, lying transversely beneath the integument; a median space above and below the intestine, communicating each with the circular space, and lying between the right and left lamellæ of the mesentery. Joined to these there was also the above-mentioned intestinal sinus. Thus the method of origin of the segmented secondary body-cavity depicted above would at the same time have led to the formation of the chief portions of the vascular system, as a naturally resulting consequence of the given spacial relations.

Among the peritoneal structures of the Annelids, the neural and hæmal longitudinal muscles require special attention from the difficulty of divining the causes of their first appearance. I have formed the following as yet very hypothetical conceptions of these causes. Part of the non-reproductive elements of the wall of the sexual gland I regard as epithelio-muscle cells, the bodies of which were in the epithelial layer of the follicle wall, while the distal parts elongated as fibrils at each end and tangential to the surface of the gland, when contracting exercised pressure upon the contents of the follicle cavity (were thus functional originally in the discharge of the sexual products). After the

follicle walls had applied themselves to the integument and to the intestine, and had adhered to them, these follicle-muscles could no longer function as such, and disappeared, except in the familiar longitudinal areas on the external body-wall, where they at first strengthened the primary longitudinal musculature, and later entirely supplanted it.

Thus in the perfected organization of the Annelids we would look in vain for a primary longitudinal trunk musculature (perhaps excepting the Hirudinea); but, on the other hand, all the muscles arising from the embryonic mesenchym, as enumerated above, are to be regarded as handed down, with corresponding changes, from the parenchymatous ancestors. In this category belong the transverse muscles, so characteristic of the Annelids, and which are specially well developed in good swimmers. They may have moved from the intraseptal muscle region into the segmental cavity in a horizontal direction to increase the swimming movements, and have thus brought about a subdivision of the cœlom into intestinal and nephridial or lateral chambers.[7]

From the parenchym also arises the retroperitoneal connective tissue, which, though occurring in Annelids in only small quantity, in some cases has a truly parenchymatous character, as cartilage-like supporting tissue. In addition, also, the blood corpuscles[8] in the blood vessels are a remnant of the primitive body-cavity.

The excretory system of the Platyhelminths is commonly regarded as belonging to the parenchym. Scarcely any one doubts that the larval nephridia of the Annelids are homologous to part of that system. I would also derive the definite nephridia, as has been variously done already, from these Turbellarian organs. In this I am guided chiefly by the occurrence of segmentally arranged primary nephridia in many larvæ (two pairs in Polygordius, five pairs in Nereis and Dinophilus), as well as

[7] Since, to all appearances, the so-called protovertebræ of the Vertebrates correspond to the lateral chambers of the Annelids, we would have to refer their ultimate origin to the mode of swimming in the Annelid ancestor, to the formation of these specific, transverse swimming muscles.

[8] Morphologically opposed to these proper blood corpuscles are the lymph corpuscles in the cœlom, which, arising from the peritoneum, form, to a certain extent, secondary leucocytes, and are possibly related to the sexual products, somewhat as the cellular products of the yolk glands in the Platyhelminths.

by the undoubtedly separate origin of the middle excretory portion of the permanent organ (as in Psygmobranchus), which does not come from the peritoneum. It is to be especially emphasized that I would leave entirely out of the question the statements regarding the occurrence of longitudinal canals in Annelids: that concerning Polygordius as not confirmed by any of the subsequent studies, and my own concerning Lanice as being much more likely a secondary than a primitive condition, contrary to my former unpublished opinion. Yet for my part I still believe, in spite of the criticism of this conception by Berg, with its quite unnecessary and unbecoming additions, that the nephridial tubes are to be regarded as parts of a pair of longitudinal canals, such as the Turbellarians have; in which, in consequence of intersegmental constriction of the body, the excreted fluid was checked, and first gave rise to segmentally arranged openings, after which an ultimate division into segmented sections could take place. To the canals, that were primitively closed internally and provided with fine side branches and end cells, were added in Annelids new structures in the shape of peritoneal funnels. Thence the mode of action of the organ gradually, though not radically, changed considerably, and the entire original terminal portion quite disappeared, as being superfluous. Regarding the original signification of the nephridial funnels, we must bear in mind that the segmentation of the primitively uniform pair of sexual glands must give rise to a corresponding number of paired discharging channels for the sexual products. As in Nemerteans, these could appear as centrifugal outgrowths of the follicle wall, and in many cases they may have met the metameric nephridial tubes (instead of reaching the skin directly), have joined to them so that eggs and sperm were discharged from the body, and thus have been transformed into nephridial funnels.[9]

[9] Berg formerly expressed the opinion that the definitive nephridia of Annelids were the canals for the sexual products, and arose originally from the walls of the sexual follicles. In my opinion, this idea is justified only in the above restricted form,—only in reference to the nephridial funnels. Moreover, Berg in accepting Kleinenberg's conception of the mesoderm should, consistently, have given up that opinion, since according to Kleinenberg there are no mesodermal somites comparable to the Nemertean gonads. Yet he affirms that he has retained his opinion of the Annelid nephridium unchanged. An explanation seems necessary!

As regards the ectodermal structures, I wish to be as brief as possible here, and to postpone their more particular consideration to my more detailed publication.

In my opinion, the permanent nervous system of the Annelids is undoubtedly to be derived quite directly from the condition found in the Turbellarians. We are to assume here that in the parenchymatous ancestor, probably, the fusion of ganglia around sense organs to make up the chief centers (as shown in the ontogeny of Annelids) had already been completed. I regard the entire larval system, including the ring nerve of the ciliated band and its ganglia, as a special modification of a still older, originally diffuse, subcutaneous nerve-cell plexus. In accordance with this, the ciliated band would not at all have the significance which has been often ascribed to it, but, like the larval form itself, would be only a secondarily acquired peculiarity of an embryo forced into a pelagic life.

The setæ are characteristic of the Annelids; but even in the Turbellaria similar, though quite superficial, skin formations occur, as for example in the *Enantia spinifera* described by V. Graff. From such dermal armament, at first irregularly distributed, may have arisen the true Chætopodia. And here it is to be noted that in Enantia the cuticular hooks occur laterally upon the entire margin of the body, with the sole exception of the head region, just as the Chætopodia are confined strictly to the trunk of the Annelid.

We may regard the head tentacles and trunk cirri as having arisen as evaginations of specially sensitive regions of the integument; and since vascular loops were drawn into such hollow processes, they became capable of serving at the same time as respiratory organs for the body. The fact that in the trunk the dorsal cirri, or some of them, became true dorsal branchiæ had its origin in that these were least exposed to injury in occasional movements of the worm upon solid substances, and thus admitted of a thining of the integument necessary for respiration. The ventral processes came much more into contact with the substratum, and hence became the bearers of an increased sense of touch.

In the digestive tract it is especially the origin of the pharyngeal apparatus that seems to require explanation; but even here the matter is pretty simple if we regard this as an originally circular evaginable part of the foregut epithelium, provided with radiating muscle cells and covered by circular and longitudinal muscle layers, much as we still find in Annelids. Such a condition may without difficulty be derived from the Turbellarian pharynx. But the armament of teeth and their retraction into special sacs of the pharynx are doubtless acquisitions of a later period in the phylogenetic history of our worm.

But little is to be said concerning the phylogenetic development of the remaining regions of the digestive tract; yet this much is probable, that the Turbellarian-like ancestor of the Annelids had no such branched intestine as the present Planarians, which have acquired it along with the flattening and broadening of the body, but had a simple intestinal tube, as in the Nemerteans, ending posteriorly in an anus.

As a direct corollary from the history of the Annelid body, given here in its general outlines, there results a very definite conception of the morphological signification of the mesoderm, as I have already stated in my above-mentioned communication.

Thus, if in Annelids the peritoneal sacs, with all their derivatives, as well as the segmental cavities in them, are to be derived from the sexual glands of their ancestors, then their stages of development in ontogeny, the mesoderm somites and mesoderm-bands, and finally, to be consistent, also in general the secondary or cœlomic mesoderm of all Metazoa which have it, must have the original signification of a sexual tissue or of gonads.[10]

[10] One of the best evidences would be furnished by a case in which the secondary mesoderm was entirely devoted to the formation of the sexual glands of the adult animal. Such a case seems actually presented, according to the account of S. F. Harmer, in the male of *Dinophilus tæniatus*, a new species of these creatures resembling Annelid larvæ. Here two solid cell-bands in the primary body-cavity, comparable to the mesoderm-bands, are transformed into the anteriorly bifurcated testes, the large cavity of which the author quite justly regards as homologous with the secondary body-cavity of Annelids. On the other hand, the statement of Kleinenberg that the sexual glands in Lopadorhynchus arise directly from the ectoderm by invagination, would furnish very strong evidence on the other side; yet I have convinced myself by my own observations upon the same animal that there is an error here, and that the organs mentioned are formed as usual from the peritoneum.

Yet how can structures have the same phylogenetic origin when they, to all appearances, arise now from the ectoderm, now from the entoderm? The ingenious idea of Kleinenberg, that "the sexual cells do not come from the germ layers," will help us out of this difficulty when properly applied. He says further "that they already existed in the ancestors of the Cœlenterates when composed of loosely arranged similar cells, not yet differentiated into ectoderm and entoderm." I would here replace "Cœlenterate" by "Metazoa," since I cannot regard these radiate creatures as the ancestors of the Bilateralia, but only as animals in which the structure of the body has undergone this special transformation, owing to a previous sedentary mode of life. This, indeed, may well have been the case in all animals with radiate symmetry.

Such primary germ-cells would then have originally formed the origin of the secondary or cœlomic mesoderm, and hence belong as little to one as to the other of the two primary germ layers, but are merely interpolated for a time amongst the elements of one layer or the other in the beginning of ontogeny in the Metazoa. Only we are, however, not able to distinguish them from their neighboring cells. So that it does not signify if they subsequently move into the primary body-cavity as "pole-cells," or temporarily remaining in their first surroundings, furnish cell masses growing into the blastocœl, or else by multiplying in situ form epithelial surfaces that subsequently become completely separated.[11] Thus, as far as the cœlomic mesoderm is concerned, the discussion as to its ectodermal or entodermal origin becomes quite unnecessary. Since the primary germ-cells probably lay on the boundary between the outer and inner layers, where they obtained both favorable conditions of nutrition and the possibility of discharging their derivatives by the shortest route, they could, later on, get into the ectoderm as easily as into the entoderm.

[11] By a similar method Rabl has recently shown how the cœlomic diverticula of the archenteron may be referred to the germ-bands that arise from pole-cells. Whether his "numerical law" is applicable or not, he has thus given a valuable explanation of the apparently different modes of development of such structures; but he is in error when he thinks he can show that the mesoderm universally takes its origin from the entoderm.

We still have the consideration of the question as to the original significance of the embryonic mesenchym. Here again, as it seems to me, the development of the Annelids will help us into the right track,—especially that method of formation of the primary mesoderm which is found in Lopadorhynchus and many other Annelids. The paired rudiment on both sides of the anus in the ectoderm represents, according to Kleinenberg, the chief neuro-muscle origin for the ventral band and the permanent mesodermal structures, but contains, as I think, two different, though closely compressed, formative centres,—that of the permanent trunk nervous system, and that of the secondary mesoderm. There are here, in addition, a series of regions in the ectoderm (considered as "neuro-muscle Anlagen" by Kleinenberg) that, in my opinion, furnish the mesenchym, represented in this special case, to be sure, only by mesenchym muscles. In investigating Lopadorhynchus larvæ I found, however, more of such mesenchym "anlagen" than my predecessor, and as a rule lying in the regions where the elements arising from them subsequently are attached as muscles to the ectoderm.

This discovery, and the circumstance that in other forms there arise from the mesenchym, in addition to the muscles, connective tissue, the larval and parts of the definitive excretory organs, as well as the migrating cells of the primary body-cavity (primary leucocytes), and probably also the true blood corpuscles, that such migratory cells (as in the Echinoderms) may be formed also from the entoderm, suggests the conclusion that morphologically the embryonic mesenchym is not a uniform structure, but represents rather the sum of the undifferentiated "Anlagen" of very various organs and tissues, which originally arose quite independently from the ectoderm or entoderm, and wherever necessary.

It is not as easy to explain the origin of mesenchym structures by the migration in many cases of cells from the embryonic cœlomic epithelium. In such cases we might assume that the various constituents of the mesoderm had united in a common origin. Then in cases where the entire mesoderm is formed by evagination, or through outgrowths of one or both germ layers, the mesenchymatous and cœlomic embryonic elements may be

simply mixed with one another. But where its rudiment is represented by a single pair of pole-cells these must be regarded as blastomeres precociously removed into the blastocœl, and containing in themselves the future sources of the primary and secondary mesoderm, still unseparated. Since the mesenchym has here and there its own pole-cells,—for we must regard as such the nephroblasts of Whitman and Wilson, and the lateral teloblasts of some Hirudinea and Oligochæta according to the later observations of Berg upon the Lumbricidæ,—those mesoderm pole-cells that later give rise to both primary and secondary mesoderm may have been at one time blastomeres, which by division gave rise to the pole-cells of the cœlomic mesoderm, as well as to mesenchym pole-cells, but which later no longer divided.

The above very sketchy presentation of my views of the mesoderm may be summed up as follows: As in Kleinenberg's theory, the entire mesoderm is not to be regarded as a uniform structure of equal significance with the two primary germ layers, but as a combination of "Anlagen" of very diverse organs that arose at one time entirely independently of one another. But an important element of it, the so-called secondary cœlomic mesoderm, or the genito-peritoneal embryonic tissue, as I would call it, has, as contrasted with the embryonic mesenchym, the significance of a primitive organ,—namely, of an ancestral sexual or gonad tissue that arose from the primary sexual cells, belonging to neither germ layer, in the oldest many-celled animals.

Warsaw, April, 1890.

RECORD OF AMERICAN ZOOLOGY.

BY J. S. KINGSLEY.

(Continued from Vol. XXIV., page 1047.)

IT is the intention to catalogue here in systematic order all papers relating to the Zoology of North America, including the West Indies, beginning with the year 1889. An asterisk indicates that the paper has not been seen by the recorder. Owing to the method of preparation it is impossible to collect in one issue all the papers relating to any group, but it is hoped that succeeding numbers will correct this. Authors are requested to send copies of their papers to J. S. Kingsley, Lincoln, Nebraska.

VERTEBRATA.

COPE, E. D.—The homologies of the fins of fishes AM. NAT., XXIV., p. 401, 1890.

MINOT, C.-S.—The concrescence theory of the vertebrate embryo. AM. NAT., XXIV., pp. 501, 702, 1890.

AYERS, H.—Contribution to the morphology of the vertebrate head. *Zool. Anz.*, XIII., p. 504, 1890.—Describes sense organs of the Amphioxus, and discusses segmentation of vertebrate head.

BAUR, G.—On the morphology of the vertebrate skull. *Jour. Morph.*, III., p. 467, 1889 [1890].

HERRICK, C. L.—Suggestions upon the significance of the cells of the cerebral cortex. *Microscope*, X., p. 34, 1890.

PORTER, WM. T.—The presence of Ranvier's constrictions in the spinal cord of vertebrates. *Quart. Jour. Micros. Sci.*, XXXI., p. 91, 1890.

MINOT, C.-S.—Evolution of the medullary canal. AM. NAT., XXIII., p. 1019, 1889 [1890].

COPE, E. D.—Synopsis of the families of vertebrates. AM. NAT., XXIII., p. 849.

Nagakawa, Isaac.—The origin of the cerebral cortex and the homologies of the optic lobe layers in the lower vertebrates. *Jour. Morph.*, IV., p. 1, 1 pl., 1890.

McClure, C. F. W.—The segmentation of the primitive vertebrate brain. *Jour. Morph.*, IV., p. 35., pl. iiii., 1890.—*Vide* Am. Nat., XXIV., p. 187.

Gibbes, H.—The crescent cells of Gianuzzi. *Microscope*, p. 65, 1890.

ELASMOBRANCHII.

Platt, J. B.—The anterior head-cavities of Acanthias. *Zool. Anz.*, XII., p. 239, 1890.—Describes a pair of cavities in front of the premandibular.

Eigenmann, C. H. and R.—Notes from the San Diego Biological Laboratory. *West Am. Scientist*, VI., pp. 123, 147, 1889.—Notes on two sharks and on the embryos of five Elasmobranchs.

Bean, T. H.—Description of a new Cottoid fish from British Columbia. Proc. U. S. Nat. Mus., XII., p. 641, 1890.—*Synchirus* [n.g.] *gillii.*

TELEOSTS.

Bean, T. H.—A hybrid between the lake trout and brook trout. Bull. U. S. F. C., VII., p. 216, 1889.

Brakeley, John H.—Rapid growth of carp due to abundance of food. Bull. U. S. F. C., VII., p. 20, 1889.

Smiley, C. W.—Loch Leven trout introduced into the United States. Bull. U. S. F. C., VII., p. 28, 1889.

Hamilton, W. R.—Croaking of the perch. Bull. U. S. F. C., VII., p. 63, 1889.—In *Haploidonotus grunniens* caused by moving grinders.

Earll, R. E., and Smith, H. M.—The American sardine industry in 1886. Bull. U. S. F. C., VII., p. 161, 1889.—History and statistics.

Ravenel, W. deC.—Information bearing upon the artificial propagation of mullet. Bull. U. S. F. C., VII., p. 197, 1889.

Jordan, D. S.—Note on the occurrence of the opah (*Lampris guttata*) on the Grand Banks. Bull. U. S. F. C., VII., p. 202, 1889.

Duclos, G.—La perche argentée d'Amerique ou calicobass.

**Rev. Sci. Nat. Appl.*, No. 1., p. 12, Jan. 1889. Trans. in Bull. U. S. F. C., VII., p. 215, 1889.

EARLL, R. E.—Notes on certain fishery industries of Eastport, Maine, in 1886. Bull. U. S. F. C., VII., p. 267, 1889.—Herring.

GILL, T. N.—The families of ribbon-fishes. AM. NAT., XXIV., p. 481, 1890.

RYDER, J. A.—The continuity of the primary matrix of the scales and the actinotrichia of Teleosts. AM. NAT., XXIV., p. 489, 1890.

JORDAN, D. S—Catalogue of fishes collected at Port Castries, St. Lucia, by the steamer *Albatross*, November, 1888. Proc. U. S. Nat. Mus., XII., p. 645, 1890.—87 species; revision of Harengula; *Corvula sanctæ-luciæ* new.

GILBERT, C. H.—A preliminary report on the fishes collected by the steamer *Albatross* on the Pacific coast of North America during the year 1889, with descriptions of twelve new genera and ninety-two new species. Proc. U. S. Nat. Mus., XIII., p. 49, 1890. The new genera are Leuroglossus, Calotomus, Radulinus, Bathyagonus, Xenochirus, (preoc.) Gillellus, Cryptotrema, Plectobranchus, Lucioblennus, Aprodon, Lycodapus, Lioglossina.

JORDAN, D. S., AND EVERMANN, B. W.—Description of a new species of fish from Tippecanoe River, Indiana. Proc. U. S. Nat. Mus., XIII., p. 3, 1890.—*Etheostoma tippecanoe*.

BEAN, T. H.—Report on the fishes observed in Great Egg Harbor Bay, New Jersey, during the summer of 1887. Bull. U. S. F. C., VII., p. 129, 1889.—Annotated list of 101 species.

* THOMPSON, D'ARCY W.—On the auditory labyrinth of *Orthagoriscus mola*. Stud. Mus. Zool. Dundee, I., No. 4.

TEST, F. C.—New phosphorescent organs in Porichthys. Bull. Essex Inst., XXI., p. 43, 1889.

MATHER, FRED.—Report upon the results of salmon planting in the Hudson River. Bull. U. S. F. C., VII., p. 409, 1889.

DRESSLAR, F. B., AND FESLER, B.—A review of the mackerels (Scombrinæ) of America and Europe. Bull. U. S. F. C., VII., p. 429, 1889.—Fifteen species recognized: *Scomber scombrus*, *S. colias*, *Auxis thazard*, *Gymnosarda pelamis*, *G. alliterata*, *Albacora alalonga*, *A. thynnus*, *Sarda sarda*, *S. chilensis*, *Scombero-*

morus concolor, *S. maculatus*, *S. regalis*, *S. cavalla*, *Acanthocybium solandri*, occurring in North America.

BEAN, T. H.—New fishes collected off the coast of Alaska and the adjacent region southward. Proc. U. S. Nat. Mus., XIII., p. 37, 1890.—Results of *Albatross* collections; 17 new species described; the new genera are Bothrocara, Poroclinus, Dasycottus, Malacocottus.

EIGENMANN, C. H. AND R. S.—Description of a new species of Cyprinodon. Proc. Cal. Acad., II., p. 270, 1889.—*C. nevadensis*.

EIGENMANN, C. H. AND R. S.—A list of the American species Gobiidæ and Callionymidæ, with notes on the specimens contained in the Museum of Comparative Zoology at Cambridge Massachusetts. Proc. Cal. Acad., II., i., p. 51, 1889.—74 species enumerated; Clevelandia, n. g.

EIGENMANN, C. H. and R. S.—Notes from the San Diego Biological Laboratory. *West Amer. Scientist*, VI., pp. 124, 147, 1889. —List of 49 Teleosts from Cortez Banks; the new forms are: *Myctophum californiense*, *M. townsendi*, *Notoscopelus brachycheir*, *Ditrema orthonotus*, *Sebastichthys levis*, *Icelinus australis*, *Paricelinus* [n.g.] *hopliticus*. Follows with additions to fauna of San Diego; description of *Phoxinus clevelandi* from Napa County, California, and list of fishes of Allen Springs.

GILL, T. N.—The Halosauroid fishes typical of a special order. AM. NAT., XXIII., p. 1015, 1889 [1890].

——The Notacanthid fishes as representatives of a peculiar order; *l. c.*, p. 1016.

EIGENMANN, C. H.—On the genus Clevelandia. AM. NAT., XXIII., p. 916, 1889 [1890].

——The development of *Micrometrus aggregatus*, one of the viviparous surf-perches. AM. NAT., XXIII., p. 923, 1889 [1890].

BAUR, G.—On the morphology of the ribs and the fate of the actinosts of the medians fins in fishes. *Jour. Morph.*, III., p. 463, 1889 [1890].

BATRACHIA.

RYDER, J. A.—On a brood of larval Amphiuma. AM. NAT., XXIII., p. 927, 1889 [1890].

Hay, O. P.—The skeletal anatomy of Amphiuma during its earlier stages. *Jour. Morph.*, IV., p. 11, pl. ii., 1890.—Extension of paper in Am. Nat., XXII., p. 315, 1888.

Garman, S. W.—Reptiles and Batrachians from the Caymans and from the Bahamas. Bull. Essex Inst., XX., p. 101, 1889—*Vide* Am. Nat., XXIII., p. 918.

REPTILIA.

Baur, G.—The genera of the Podocnemididæ. Am. Nat., XXIV., p. 482, 1890.

——Note on the genera Hydraspis and Rhinemys. Am. Nat., XXIV., p. 484, 1890.

——The genera of the Cheloniidæ. Am. Nat., XXIV., p. 486, 1890.

——On the classification of the Testudinata. Am. Nat., XXIV., p. 530, 1890.

Aldrich, C. A.—Snakes in high places. Am. Nat., XXIV., p. 782, 1890.

Cope, E. D.—Snakes in banana bunches. Am. Nat., XXIV., p. 782, 1890.

Stejneger, L.—Annotated list of Reptiles and Batrachians collected by Dr. C. Hart Merriam and Vernon Bailey on the San Francisco mountain plateau and the desert of the Little Colorado, Arizona, with descriptions of new species. *North American Fauna*, No. 3, p. 103, 1890.—19 species enumerated, of which *Crotaphytus baileyi* is new; in foot-notes *Crotaphytus silus* (Cal., Wash.), *Uta palmeri* (Gulf of Cal.), *Uta laevis* (N. Mex.), are described.

Boulenger, G. A.—First report on additions to the lizard collection in the British Museum. Proc. Zool. Socy. London, 1890, p. 77.—New species from America is *Anolis panamensis*.

Shufeldt, R. W.—Contributions to the study of *Heloderma suspectum*. Proc. Zool. Socy. London, 1890, p. 148.—Extended study of its anatomy.

Stejneger, L.—Description of a new lizard from Lower California. Proc. U. S. Nat. Mus., XII., p. 643, 1890.—*Cnemidophorus labialis*.

BAUR, G.—The relationship of the genus Dirochelys. AM. NAT., XXIII., p. 1099, 1889 [1890].

RIVERS, J. J.—Habitat of *Xantusia riversiana*. AM. NAT., XXIII., p. 1189, 1889 [1890].

* FEILDEN, H. W.—Notes on the Reptiles of Barbadoes. *Zoologist*, XIII., p. 295, 1889. Addendum, p. 352.

GARMAN, S. W.—Reptiles and Batrachians from the Caymans and from the Bahamas. Bulletin Essex Inst., XX., p. 101, 1889. —*Vide* AM. NAT., XXIII., p. 918, 1889.

BIRDS.

STEJNEGER, L.—Contributions to the history of Pallas's cormorant. Proc. U. S. Nat. Mus., XII., p. 83, 1889 [1890].—A catalogue of specimens; publication of Brandt's description and account of finding of bones.

LUCAS, F. A.—Description of some bones of Pallas's cormorant (*Phalacrocorax perspicillatus*). Proc. U. S. Nat. Mus., XII., p. 88, 1889 [1890].—Descriptions and figures of bones found by Dr. Stejneger.

* SCLATER, P. L.—Catalogue of the birds in the British Museum. Vol. XV., pp. 371, London, 1890.—Contains families of Dendrocolaptidæ, Formicariidæ, Conopophagidæ, Pteroptochidæ.

DURY, CHAS.—Notes on Ohio birds. Jour. Cin. Socy. Nat. His., XIII., p. 93, 1890.—Nominal list of forms seen at Avondale.

SHUFELDT, R. W.—On the position of Chamæa in the system. *Jour. Morph.*, III., p. 475, 1889 [1890].

* FLAGG, W.—A year with the birds, or the birds and seasons of New England. Boston, 1890, pp. 317.

* ——American Ornithologists' Union. Check-list of North American birds. Second supplement, New York, 1890.

* WATERHOUSE, F. H.—Index generum avium. A list of the genera and subgenera of birds. London, 1889, p. 240.

* BRYANT, W. E.—Unusual resting sites. Proc. Cal. Acad. Sci., II., i., p. 7.

RIVES, W. C.—Notes on the birds of White Top Mountain, Va. *Auk*, VI., p. 50, 1889.

SHARP, B.—Change of habit causing change of structure.

Proc. A. N. S. Philadelphia, 1889, p. 347, 1890.—Notes changes in *Colaptes auratus.*

PLATT, J. B.—Studies on the primitive axial segmentation of the chick. Bull. Mus. Comp. Zool., XVII., p. 171, 1889.

CHENEY, J. V.—The notes of some of our birds, AM. NAT., XXIV., p. 745, 1890.

MERRIAM, C. H.—Annotated list of birds of the San Francisco mountain plateau and the desert of the Little Colorado River, Ariz. *North American Fauna,* No. 3, p. 87, 1890.—List of 151 species.

*CORY, C. B.—The birds of the West Indies, including all species known to occur in the Bahama Islands, the Greater Antilles, the Caymans, and the Lesser Antilles, excepting the islands of Tobago and Trinidad. Boston, 1889, 324 pp., 2 maps.

SCLATER, P. L.—List of birds collected by Mr. Ramage in Dominica, W. I. Proc. Zool. Socy. London, 1889, p. 326.

* SHUFELDT, R. W.—Osteological studies of the subfamily Ardæinae. *Jour. Compar. Med. and Surg.,* 1889.

* ——Osteology of *Circus hudsonius; l. c.,* 1889.

ALLEN, J. A.—Notes on Florida gallinule. *Auk,* VI., p. 274, 1889.

BROWN, J. C.—Winter notes from Portland, Me. *Auk,* VI., p. 280, 1889,

BOND, F.—Notes from Wyoming. *Auk,* VI., p. 341, 1889.

BREWSTER, W.—Nesting habits of the parakeet (*Conurus carolinensis*). *Auk,* VI., p. 336, 1889.

——*Dendroica coronata* feeding upon oranges. *Auk,* VI., p. 279, 1889.

——The present status of the wild pigeon (*Ectopistes migratorius*) as a bird of the United States, with some notes on its habits. *Auk,* VI., p. 337, 1889.

——*Melanerpes carolinus* eating oranges. *Auk,* VI., p. 337, 1889.

BENDIRE, C. E.—Description of the nest and eggs of *Megascops asio maxwelliæ,* the Rocky Mountain screech owl. *Auk,* VI., p. 298, 1889.

CHAMBERLAIN, M.—Some account of the birds of Southern

Greenland, from the MS. of A. Hagerup. *Auk*, VI., p. 211, 1889.

CANTWELL, G. G.—Notes from Minnesota. *Auk*, VI., p. 340, 1889.

CHAPMAN, F. M.—Notes on birds observed in the vicinity of Englewood, N. J. *Auk*, VI., p. 302, 1889.

——*Helminthophila bachmanii* no the east coast of Florida. *Auk*, VI., p. 278, 1889.

CORY, C. B.—Notes on West Indian birds. *Auk*, VI., p. 218, 1889.

——A new duck for Massachusetts, *Nomonyx dominicus*. *Auk*, VI., p. 336, 1889.

CHADBOURNE, A. P.—An unusual flight of killdeer plover along the New England coast.' *Auk*, VI., p. 255, 1889.

COX, P. A.—A bird wave. *Auk*, VI., p. 241, 1889.

EAMES, E. H.—The fish-crow (*Corvus ossifragus*) in Connecticut. *Aux*, VI., p. 338, 1889.

——Notes on the blue-winged warbler and its allies in Connecticut. *Auk*, VI., p. 305, 1889.

HASBROUCK, E. M.—Summer birds of Eastland County, Tex. *Auk*, VI., p. 236, 1889.

JEFFERIES, W. A.—Birds observed at Santa Barbara, Cal. *Auk*, VI., p. 220, 1889.

JOHNSON, L. N.—The wild turkey in the North Carolina mountains. *Auk*, VI., p. 275.

JOHNSON, F. O.—*Polioptila plumbea* at Palm Springs, California. *Auk*, VI., p. 280.

KIMBALL, F. H.—Mortality among eave-swallows. *Auk*, VI., p. 338.

LOOMIS, L. M.—The raven as a South Carolinian. *Auk*, VI., p. 277.

MORRIS, R. O.—Birds near Springfield, Mass. *Auk*, VI., p. 340.

PINDER, L. O.—List of the birds of Fulton County, Kentucky. *Auk*, VI., p. 310.—183 species.

RICHMOND, C. W.—The yellow-throated warbler (*Dendroica dominica*) near Washington. *Auk*, VI., p. 339.

RAGSDALE, G. H.—On the hiatus existing between the breeding

ranges of the loggerhead and white-rumped shrikes. *Auk*, VI., p. 224.

REED, J. H.—*Troglodytes aëdon* (house wren) building in a hornet's nest. *Auk*, VI., p. 339.

SCOTT, W. E. D.—A summary of observations on the birds of the Gulf coast of Flordia. *Auk*, VI., p. 245, 318.—Cont. of article (*vide* AM. NAT., XXIV., p. 544).

RICHARDSON, J.—The Florida gallinule breeding in Vermont. *Auk*, VI., p. 273.

SCOTT, W. E. D.—On the specific identity of *Buteo brachyurus* and *Buteo fuliginosus*, with additional records of their occurrence in Florida. *Auk*, VI., p. 243.

——A second specimen of Cory's bittern (*Botaurus neoxenus*). *Auk*, VI., p. 317.

SAGE, J. H.—The interbreeding of *Helminthophila pinus* and *H. chrysoptera*. *Auk*, VI., p. 279.

SENNETT, G. B.—*Micropallas whitneyi* (elf owl) taken in Texas. *Auk*, VI., p. 276.

——A new species of duck from Texas. *Auk*, VI., p. 263.—*Anas maculosa.*

TORREY, B.—The killdeer plover wintering on the New England coast. *Auk*, VI., p. 274.

THORNE, P. M.—*Phalaropus lobatus* and *Phalaropus tricolor*. *Auk*, VI., p. 366.

WASHBURN, F. L.—Recent capture of Kirtland's warbler in Michigan, and other notes. *Auk*, VI., p. 279.

BARROWS, W. B.—The English sparrow (*Passer domesticus*) in North America, especially in its relations to agriculture. Dept. of Agric., Washington, 1889, pp. 405 and map.

* DAVIS, OLIVER.—Nests and eggs of North American birds. 3d edit., Columbus, 1889, 455 pages, 13 plates.

* FEILDEN, HENRY W.—On the birds of Barbados. *Ibis*, VI., i., p. 477.

*——*Tringa canutus* in Barbados. *Zoologist*, III., xiii., p. 455, 1889.

* NEHRLING, H.—Die nordamerikanische Vogelwelt. Milwaukee, 1889.—Publishing in parts.

* SALVIN, O.—A list of the birds of the islands of the coast of Yucatan and of the Bay of Honduras. *Ibis*, VI., i., p. 359.

* SALVIN, O., AND GODMAN, F. d. C.—Notes on Mexican birds. *Ibis*, VI., i., p. 232 and 380.—9 new species.

* BRYANT, W. E.—Birds and eggs from the Farralone Islands. Proc. Cal. Acad., II., i., p. 25.

*——Description of a new subspecies of song sparrow from Lower California. Proc. Cal. Acad., II., i., p. 197.—*Melospiza fasciata rivularis*.

* BELDING. L.—The humming birds of the Pacific coast north of Cape St. Lucas. *W. A. Scientist*, VI., p. 109, 1889.

* PASTNOR, P.—The American woodcock and its mode of feeding. *Zoologist*, III., xiii., p. 395, 1889.

* STEJNEGER, L.—[On Platalea.] *Ibis*, VI., i., p. 258.

——On the eastern and western forms of the nutcracker. *Zoologist*, III., xiii., p, 441, 1889.

MAMMALS.

BOWEN, J. T.—The epitrichial layer of the human epidermis. *Anat. Anz.*, IV., pp. 412 and 441, 1889.

TUCKERMAN, F.—An undescribed taste area in *Perameles nasuta*. *Anat. Anz.*, IV., p. 411, 1889.

BAUR, G.—Neue Beiträge zur Morphologie des Carpus der Säugethiere. *Anat. Anz.*, IV., p. 49, 1889.

HORNADAY, W. T.—How to collect mammal skins for purposes of study and for mounting. Rep. Sm. Inst. for 1885–86, Pt. II., p. 659, 1889.

TRUE, F. W.—A review of the family Delphinidæ. Bull. U. S. Nat. Mus., No. 36, 1889.—See AM. NAT., Dec. 1889.

COPE, E. D.—The Cetacea. AM. NAT., XXIV., p. 599, 1890.

ALLEN, J. A.—A review of some of the North American ground squirrels of the genus Tamias. Bull. Am. Mus. Nat. Hist., III.—*Vide* AM. NAT., XXIV., p. 681, 1890.

COPE, E. D.—The extinct Sirenia. AM. NAT., XXIV., p. 697, 1890.

HOWELL, W. H.—The life-history of the formed elements of the blood, especially the red blood corpuscles. *Jour. Morph.*, IV., p. 57, pl. IV., 1890.

——Observations upon the occurrence, structure, and function of the giant cells of the marrow. *Jour. Morph.*, IV., p. 117, pl. v., 1890.

MERRIAM, C. H.—Results of a biological survey of the San Francisco mountain region and desert of the Little Colorado, Ariz. *North American Fauna*, No. 3, 1890.—Gives (p. 37) list of 21 species noted at the Grand Cañon of the Colorado, and (pp. 43–86) list of mammals of region; the following are new: *Sorex monticolus*, *Vespertilio melanorhinus*, *Tamias cinnamomeus*, *Spermophilus pratensis*, *S. obsidianus*, *S. cryptospilotus*, *Onychomys fuliginosus*, *O. pallescens*, *Hesperomys megalotis*, *H. rufinus*, *Arvicola alticolus*, *Dipodophis* [n.g.] *longipes*, *Perognathus fuliginosus*, *Lynx baileyi*, *Mephitis estor*, *Spilogale gracilis*.

DOBSON, G. E.—A synopsis of the genera of the family Soricidæ. Proc. Zool. Socy. London, 1890, p. 49.—Neosorex and Atophyrax are merged in Sorex.

THOMAS, O.—On a collection of mammals from Central Vera Cruz, Mex. Proc. Zool. Socy. London, 1890, p. 71.—21 species and varieties enumerated; *Sciurus niger melanotus* and *Lepus veræcrucis* new.

MINOT, C.-S.—Die Placenta des Kaninchens. *Biol. Centralbl.*, X., p. 114, 1890.

ALLEN, H.—Description of two new species of bats, *Nyctinomus europs* and *N. orthotis*. Proc. Am. Phil. Socy., XXVI.; Proc. U. S. Nat. Mus., XII., p. 634, 1890.—The second species from Jamaica, the other from Brazil.

WHITE, P. J.—On the skull and skeleton of the Greenland shark, *Læmargus microcephalus*. *Anat Anz.*, V., p. 259, 1890.

* STEPHENS, F.—Land mammals of San Diego County, Cal. *West American Scientist*, VII., Aug. 1890.

ALLEN, H.—Remarks on the Prong-horn (*Antilocapra americana*). Proc. Am. Philo. Socy., XXVI., p. 366, 1890.

MERRIAM, C. H.—Contribution toward a revision of the little striped skunks of the genus Spilogale. *North American Fauna*, No. 4, p. 1, 1890.—Ten species recognized, of which *S. ringens* (Ala., N. C., Miss.), *S. indianola* (Tex.), *S. lucasana* (L. Cal.), *S.*

leucoparia (Tex.), *S. saxatilis* (Utah), *S. phenax* (Cal.), *S. latifrons*' (Ore.), are new.

——Descriptions of five new ground squirrels of the genus Tamias; *l c.*, p. 17.—*T. castanurus* (Utah), *T. chrysodeirus* (Oreg.), *T. cinerascens* (Mont.), *T. interpres* (Tex.), *T. melanurus* (Idaho).

——Description of a new Evotomys from Colorado; *l. c.*, p. 23.—*E. galei.*

——Descriptions of two new species of Evotomys from the Pacific coast of the United States; *l. c.*, p. 25.—*E. occidentalis* (Wash.), *E. californicus* (Cal.).

——Description of a new marten (*Mustela caurina*) from the northwest coast regions of the United States; *l. c.*, p. 27.

——Description of a new species of Molossus from California (*Molossus californicus*); *l. c.*, p. 31.

——Description of a new prairie dog from Wyoming; *l. c.*, p. 33.—*Cynomys leucurus.*

——Descriptions of three new ground squirrels of the *Spermophilus spilosoma* group; *l. c.*, p. 37.—*S. cancocens* (Ariz.), *S. macrospilotus* (Ariz.), *S. major* (New Mexico).

——Descriptions of three new species of kangaroo rats, with remarks on the identity of *Dipodomys ordii* of Woodhouse; *l. c.*, p. 41.—*ordii* belongs to genus *Dipodops;* new species are: *Dipodomys ambiguus* (Tex.), *D. spectabilis* (Ariz., Mex., N. Mex.), *D. californicus.*

——Description of a new pocket gopher of the genus Geomys, from Western Nebraska; *l. c.*, p. 51.—*G. lutescens.*

——Description of a new species of Hesperomys from Southern Florida; *l. c.*, p. 53.—*H. macropus.*

Tuckermann, F.—On the gustatory organs in Mammalia. Proc. Bost. Socy. N. H., XXIV., p. 470, 1890.

*Allen, J. A.—Notes on a collection of mammals from Southern Mexico, with descriptions of new species of the genera Sciurus, Tamias, and Sigmodon. Bull. Amer. Mus. N. H., II., p. 165.—4 new species and subspecies.

*Thomas, O.—Catalogue of the Marsupialia and Montremata in the British Museum (Natural History). London, 1889, pp. 400, pls. 28.

TUCKERMANN, F.—On the gustatory organs of the American hare (*Lepus americanus*). *Am. Jour. Sci.*, III., XXXVIII., p. 277, 1889.

* CHAPMAN, F. M.—On the habits of the round-tailed muskrat (*Neofiber alleni* True). Bull. Am. Mus. Nat. Hist., II., p. 219.

*——Description of a new species of the genus Sigmodon from Southern Florida; *l. c.*, p. 118.—*S. hispidus litoralis.*

*——Preliminary descriptions of two apparently new species of the genus Hesperomys from Florida; *l. c.*, p. 117.—*H. floridanus*, *H. niveiventris.*

POHLMANN, W.—Die Lebensweise des nordamenkanische Murmelthreres (*Arctomys monax*). *Zool. Garten*, XXX., p. 236.

BEDDARD, F. E.—Some notes on the anatomy of the American tapir (*Tapirus terrestris*). Proc. Zool. Socy. London, 1889, p. 252.

THOMAS, O.—Description of a new stenodermatous bat from Trinidad. Ann. Nat. Hist., •VI., iv., 167, 1889.—*Vampyrops caracciolæ.*

EDITORIAL.

EDITORS, E. D. COPE AND J. S. KINGSLEY.

WE congratulate our readers and other countrymen that the United States Government has at length partially removed a tax on intelligence which has been our opprobrium for many years. We refer to the duty imposed on books imported or received in exchange by private students and investigators from foreign countries. A committee to obtain this reduction was appointed by the American Association for the Advancement of Science at its New York meeting, which now consists of Profs. J. R. Eastman, Washington, S. A. Forbes, Champaign, Ill., and E. D. Cope, Philadelphia (chairman). This committee has not been inactive, and has extended its labors through several administrations. During the preparation of the Morrison tariff bill endeavors were used, which were not successful, to have scientific

books placed on the free list, Mr. Morrison himself opposing the proposition. Efforts were employed to have Senator Allison to incorporate it in the Senate bill prepared by his committee; but like the Morrison bill, this one failed to become a law. The Committee of Ways and Means of the present House, of which Mr. McKinley is chairman, were interviewed several times, and the desired provision was inserted in their bill, which is now the law of the land, having passed both House and Senate and received the signature of the President.

It was thought best by the committee of the American Association to confine its efforts to the free importation of books, and to postpone for the present the question of the free importation of scientific apparatus. The endeavor to have all scientific books placed on the free list was not successful, since a duty of twenty-five per cent. is still levied on books printed in the English language. The committee asked that books issued by the English Government, or by English scientific societies, be placed on the free list, but this was refused. It is to be hoped that this proposition will meet with more favorable consideration at the hands of the next Congress, which is not likely to favor high protective measures.

Our fellow-students have, we hope, already in many instances experienced the benefit of this change in the law, and we shall hope for still greater facilities in future, such as the nature of the case, as well as our reputation as a people, renders absolutely necessary.

—A CIRCULAR has been issued asking naturalists interested in organic morphology to meet in Boston, on December 29th, to form an Association of Morphologists, in connection with the American Society of Naturalists. Morphology is, of course, the *raison d'etre* of scientific anatomy, and a society of morphologists has a comprehensive field, which will include anatomists and naturalists of all kinds. We are heartily in favor of the existence of such a society, to correspond to the Physiological Society, etc., and to meet at the time of the American Society of Naturalists, the Geological Society, and so to form a winter American Scientific Association of experts. At present, however, we have an

Anatomical Society; and the Morphological Society, of course, conflicts with it. The two must be combined if both are to succeed, and how this is to be successfully done is the problem before us. The name "Morphological" has our preference, and we hope that it will be retained; but the membership and organization of the Anatomical Society need not be abandoned.

It is rather unfortunate that the meeting of the American Geological Society has again failed to coincide with that of the societies above mentioned. We hope that the secretaries of the respective societies will be able in future to coöperate, so that the plan of a general winter meeting of American naturalists of all kinds will not be lost sight of.

—The Association of American Agricultural Colleges and Experiment Stations has at its last two meetings amended its plan of organization in a most important manner. Originally this association was a delegate convention, consisting mainly of college presidents and station directors, who met to discuss the executive affairs of their institutions. But as the station workers increased in members and experience it became evident that there was need for the various specialists also to meet, talk over their work, and arrange plans for coöperation. The horticulturists were the first to take decisive steps, holding a meeting about three years ago. The entomologists and botanists soon followed their example by organizing independent associations. Hence it came to pass that either the scope of the original association of colleges and stations must be enlarged, or else a number of independent organizations would have to exist. Accordingly, at the Washington meeting, one year ago, the general association appointed committees on agriculture, botany, chemistry, entomology, and horticulture; and at the meeting held November 11–14, 1890, at Champaign, Illinois, these committees were changed to sections. Consequently the association now embraces all college and station investigators, and its future meetings will doubtless be second only to those of the American Association for the Advancement of Science in scientific importance.—W.

—The remarkable success attending the recent introduction of the Australian lady beetle—the Cardinal Vedalia—into the orange groves of California to destroy the Fluted Scale, has called general attention to this method of checking insect injuries, and in many quarters expectations that are hardly justified by our present knowledge of the biological laws governing the subject have apparently been raised as to the practical possibilities of this phase of economic entomology. While there can be no doubt that the introduction of the Cardinal Vedalia has proven one of the most significant triumphs in the agricultural annals of the decade, it is yet too early to draw general conclusions from its history. In cases of this kind the intricate laws regulating the interactions of organisms and adjustment to environment must be given time to operate before definite conclusions can be reached. No organism can multiply beyond the limits of its food supply. Reports from California indicate that the Cardinal Vedalia, which has so far fed exclusively upon the Fluted Scale, is rapidly reaching this limit, and it is difficult to see how there can fail to be a reaction upon its own members as fast as this limit is reached. Doubtless man can greatly assist in preventing too great a reaction by sending specimens from one locality to another. The development of these two insects—the Fluted Scale and the Cardinal Vedalia—in the orange groves of California will be watched with great interest by the entomological as well as the agricultural public.—W.

—The numbers of the American Naturalist for 1890 were issued at the following dates: January, Feb. 3d; February, Feb. 28th; March, April 3d; April, April 25th; May, June 4th; June, July 15th; July, August 8th; August, Sept. 3d; September, Oct. 14th; October, Nov. 8th; November, Dec. 6th; December, Jan. 9th, 1891.

RECENT BOOKS AND PAMPHLETS.

ABBE, C.—Waterspouts—Meteorological. Extract Bulls. Nos. 6 and 2, U. S. Scientific Exp. to Africa.

BARDELEBEN, K.—On the Præpollex and the Præhallux, with Observations on the Carpus of *Theriodesmus phylarchus*. Ext. Proc. London Zool. Soc., 1889. From the author.

BEAN, T. H.—Description of a New Cottoid Fish Collected by the U. S. Fish Commission. From the author.

BIGELOW, F.—Eclipse Photography. Bull. No. 8, U. S. Scientific Exp. to Africa.

BIGELOW, R. P.—The Marginal Sense Organs in the Pelagiidæ.—Notes on the Physiology of *Caravella maxima*. From the author.

BILLINGS, F. S.—Address before the Live Stock Breeders' Asso. From the author.

BINET, A.—The Psychic Life of Micro-Organisms. From the Open Court Pub. Co.

BRANNER, J. C.—The Training of a Geologist. Extract *Am. Geol.*, March, 1890. From the author.

BRUNER, L.—New North America Acrididæ, found North of the Mexican Boundary. Extract Proc. U. S. Nat. Mus., Vol. XII. From the Smithsonian Institution.

Bulletin Iowa State University Lab. Nat. Hist., Vol. I., No. 2.

Constitution and Membership of the National Academy of Sciences, 1889.

DAVIS, W. M., AND C. L. WHITTLE.—The Intrusive and Extrusive Triassic Trap Sheets of the Connecticut Valley. Bull. Harvard Mus. Comp. Zool., Vol. XVI.

EVANS, H. A.—The Relations of the Flora to the Geological Formations in Lincoln County, Ky. Extract *Botanical Gazette*, 1889.

FORBES, S. A., AND R. RIDGWAY.—The Ornithology of Illinois. From the Illinois State Laboratory of Nat. Hist.

GAGE, S. H.—Form and Size of the Red Blood-Corpuscles of the Adult and Larval Lamprey Eels of Cayuga Lake. Reprint from Proc. Am. Soc. Microscopists, Vol. X. 1888. From the author.

GAGE, H., AND S. P. GAGE.—Staining and Permanent Preservation of Histologica Elements Isolated by Means of Caustic Potash or Nitric Acid. Extract Proc. Am. Soc. Microscopists. From the authors.

GARMAN, H.—Preliminary Report on the Animals of the Waters of the Mississippi Bottoms near Quincy, Ill.

GARMAN, S.—Cave Animals from Southwestern Missouri. Bull. Harvard Mus Comp. Zool., Vol. XVII.

HENSOLDT, H.—Meteorites, and What They Teach Us. Extract *Am. Geol.*, 1889. From the author.

HILL, R. T.—The Foraminiferal Origin of Certain Cretaceous Limestones, and the Sequence of Sediments in North American Cretaceous. Extract *Am. Geol.*, Sept., 1889.

——Annoted Check List of the Cretaceous Invertebrate Fossils of Texas. Bull. No. 4, Geol. Survey of Texas.

——Paleontology of the Cretaceous Formations of Texas, Part I. From the author.

——Check List of Invertebrate Fossils from the Cretaceous Formations of Texas.

——Events Recorded in the Mesozoic Deposits of Southwestern Arkansas. Extract Vol. II. Annual Report of Arkansas Geological Survey for 1888. From the author.

HOUSSAY, F.—Les Industries des Animaux. From the author.

HORNADAY, W. T.—The Extermination of the American Bison. Report Nat. Mus., 1886–'87. From the author.

HOWES, G. B.—On a Rabbit with an Intra-Narial Epiglottis. Extract from the *Journal of Anatomy and Physiology*, Vol. XIII.

——Variation in the Kidney of the Common Thorn-back. Extract *Journal of Anatomy and Physiology*, Vol. XXIV. From the author.

JORDAN, D. S.—List of Fishes Collected by A. Forrer about Mazatlan.—List of Fishes Collected at Nicaragua by Dr. Birt.—Description of a New Species of Xyrichthys from the Gulf of Mexico.—Note on *Polynemus californiensis* of Thominot.—Note on the Analyse de la Nature of Rafinesque. Extracts Proc. U. S. Nat. Mus., 1887-'88.—Note on *Achirus lorentzii*.—Description of Two New Species of Fishes from South America.—Description of a New Species of Etheostoma from James River, Va.—On the Generic Name of the Tunny. Extracts Proc. Phila. Acad. Nat. Science, 1888. From the author.

JURE ET BENE.—A National Medical Society on an Elevated and Permanent Basis.

KIRSCH, P. H.—A Review of the European and American Uranoscopidæ or Star-Gazers. Extract Proc. Phila. Acad. Nat. Sci., 1889. From the author.

LEBOUCQ, H.—Recherches sur la Morphologie de la Main Chez les Mammifères Marins. Extrait des Archives de Biologie, Tome IX., 1889. From the author.

LECHE, W.—Über Hornzähne bei einem Säugetiere. Sonderabdruck aus *Anatomischer Anzeiger*, 1889. From the author.

LEWIS, H. C.—On Some Important Extra-Morainic Lakes in Central England, North America, and Elsewhere, during the Period of Maximum Glaciation, and on the Origin of Extra-Morainic Boulder Clay.—The Matrix of the Diamond. Extracts Proc. British Asso., 1887. From the auther.

LEWIS, T. H.—Sculptured Rock at Trempeleau, Wis. Extract AM. NAT., September, 1889.

LYDEKKER, R.—On the Pectoral and Pelvic Girdles and Skulls of the Indian Dicynodonts.—Note on Certain Vertebrate Remains from the Nagpur District. Reprints from Records India Geol. Survey, Vol. XXIII., Pt. I., 1890.

——On a Crocodilian Jaw from the Oxford Clay of Peterborough.—On Remains of Small Sauropodous Dinosaurs from the Wealden.—On Two New Species of Labyrinthodonts.—On a Peculiar Horn-Like Dinosaurian Bone from the Wealden. Reprints from the *Quart. Journal of the Geol. Socy.*, May, 1890.

——On Associated Remains of a Theriodont Reptile from the Karoo System of the Cape. Extract Proc. London Zool. Socy., Nov., 1889.

——On Dinosaurs of the Wealden and Sauropterygians of the Purbeck, etc.—The Occurrence of the Striped Hyæna in the Tertiary of the Val D'Arno.—Note on the Pelvis of a Ruminant from the Siwaliks.—On the Land Tortoise of the Siwalicks. Extracts Records India Geol. Survey, Vol. XXII., 1889.—Note on a Chelonian Humerus from the Middle Eocene of Bracklesham. Extract Proc. Geol. Ass., Vol. XI., No. 4.

——Catalogue of the Fossil Reptilia and Amphibia in the British Museum. Part III. From the author.

MARK, E. L.—Studies on Lepidosteus. Bull. Harvard Mus. Comp. Zool., Vol. XIX. From the author.

MASON, O. T.—The Archæology of the Tide-Water Region.—The Paleolithic Period in the District of Columbia. Extracts Proc. U. S. Nat. Mus., Vol. XII. From the author.

MILLER, S. A., AND WM. GURLEY.—Description of Some New Genera and Species of Echinodermata from the Coal Measures and Subcarboniferous Rocks of Indiana, Missouri, and Iowa. Extract Journal Cin. Soc. Nat. Hist., April, 1890. From the authors.

MORRISON, W. L.—A Review of the American Species of Priacanthidæ. Extract Proc. Phila. Acad. Nat. Science, 1889. From the author.

MURRELL, W.—What to Do in Cases of Poisoning. From the author.

NEWTON, E. T.—A Contribution to the History of Eocene Siluroid Fishes. Extract Proc. London Zool. Soc., 1889. From the author.

ORTON, E.—Origin of the Rock Pressure of Natural Gas in the Trenton Limestone of Ohio and Indiana. Extract Bull. Geol. Soc. Am., Vol. I., pp. 87–98.

PECKHAM, G. W. and E. G.—Observations on Sexual Selection in Spiders of the Family Attidæ. From the authors.

Records of the Australian Museum, Vol. I., No. 1.

Report of the Cornell University Agricultural Experiment Station, 1889.

Report of the Commissioners of Education, 1887–'88. From the Bureau of Education.

Report of the Marine Biological Laboratory, 1889.

Report of Missouri Botanical Garden, 1889.

Report of the Yorkshire Philosophical Society, 1889.

RIDGWAY, R.—A Review of the Genus Xiphocolaptes of Lesson.—A Review of the Genus Sclerurus of Swainson.—Birds Collected on the Island of Santa Lucia, Abrolhos Island, and at the Strait of Magellan, in 1878–'88. Extracts Proc. U. S. Nat. Mus., Vol. XII. From the Smithsonian Institution.

SCHLOSSER, M.—Ueber die Modifikationen des Extremitätenskelets bei Säugetierstammen. Sonderabdruck aus dem *Biologischen Centralblatt.* From the author.

SMOCK, J. C.—Sketch of George H. Cook. Extract *Am. Geol.*, December, 1889. From the author.

STEPHENSON, F. B.—Evolution of Masonry and Theology. From the author.

STEVENSON, J. J.—The Mesozoic Rocks of Southern Colorado and Northern New Mexico. Extract *Am. Geol.*, 1889. From the author.

THOMAS, O.—On the Dentition of Ornithorhyncus. Extract Proc. Roy. Soc., Vol. XLVI. From the author.

TODD, D.—The Total Eclipse. Bull. No. 4, U. S. Expedition to Africa. From the author.

TOPLEY, W., AND C. D. SHERBORN.—The *Geological Record* for 1880–'84, Vols. I. and II. From the editors.

TREAT. C. R.—Sanitary Entombment. Reprint from *The Sanitarian*, December, 1889. From the author.

TRYON, H.—Report on Insect and Fungus Pests. From the author.

TUCKERMAN, F.—An Undescribed Taste Organ in *Perameles nasuta.*—On the Gustatory Organs of *Arctomys monax.* Sonderabdruck aus *Anatomischer Anzeiger*, IV., Jahrgang, 1889.

——The Gustatory Organs of *Vulpes vulgaris.* Extract from the *Journal of Anatomy and Physiology*, Vol. XXIII.

——On the Development of the Gustatory Organs of Man. Extract *Journal of Anatomy and Physiology*, Vol. XXIII.—On the Gustatory Organs of *Putorius vison.* From the author.

TURNER, W.—On the Placentation of *Halicore dugong.* Trans. Roy. Soc. of Edinburgh, Vol. XXXV., Part II.

UPHAM, W.—The Structure of Drumlins.—Marine Shells and Fragments of Shells in the Till near Boston. Extracts Proc. Boston Soc. Nat. Hist., Vol. XXIV.—Glaciation of Mountains in New England and New York. Extract *Appalachian*, Vol. V., No. 4. From the author.

UHLER, P. R.—New Genera and Species of American Homoptera.—Additions to Observations on the Cretaceous and Eocene Formations of Maryland. Extracts Proc. Maryland Acad. Science, 1888. From the author.

VANCE, A. D.—A Confession of Faith. From the author.

VAN HISE, C. R.—The Pre-Cambrian Rocks of the Black Hills. Extract Bull. Geol. Soc., Vol. I., pp. 203–244. From the author.

WHITE, C. A.—The North American Mesozoic. Proc. A. A. A. S., Vol. XXXVIII., 1889. From the author.

WIEDERSHEIM, R. VON.—Über die Entwickelung des Schulter und Beckengürtels. Sonderabdruck aus *Anatomischer Anzeiger*, 1889.

——Beiträge zur Entwickelungsgeschichte von *Proteus anguineus*. Separatabdruck aus dem Archiv für microskop. Anatomie, Band XXXV. From the author.

WILCOX, J.—Paper on Evolution. From the author.

WILDER, B. G.—Brain Weight, etc. Reprint from The Gross Anatomy of the Brain.

——The Relation of the Thalamus to the Paracœle. Extract *Journal Nervous and Mental Diseases*, 1889. From the author.

WILLEM, V.—Note zur l'Existence d'un Gésier et sur sa Structure dans la Famille des Scolopendrides. From the author.

WILLIAMS, H. S.—The Cuboides Zone and Its Fauna; a Discussion of Methods of Correlation. Extract Bull. Geol. Soc. of America. From the author.

WOLTERSTORFF, W. VON.—Ueber die geographische Verbreitung der Amphibien Deutschlands, insbesondere Würtembergs. Separatabdruck aus Jahreshefte des Vereins für vaterl. Naturkunde in Württ., 1890. From the author.

WOOD-MASON, J.—A Catalogue of the Mantodea. From the Trustees of the Indian Museum.

WOODWARD, A. S.—Notes on Fossil Fish Remains. Extract Trans. Leic. Lit. and Philosoph. Soc., 1889. From the author.

RECENT LITERATURE.

The Trees of Northeastern America.[1]—It is rarely the case that one meets with a more satisfactory book than this designed for the non-technical reader. Too often such books are either too technical and scientific for the class of readers to which they are addressed, or, still more frequently, they are so utterly devoid of all science that they are entirely useless. The book before us more nearly strikes the golden mean between these extremes than any we have seen. Mr. Newhall has admirably succeeded in his attempt to make a book "which in simple fashion will so describe the tree from its foliage and bark and style" that one can recognize it.

The general classification adopted is as follows:

$$\text{Leaves simple}\left\{\begin{array}{l}\text{alternate}\left\{\begin{array}{l}\text{edge entire}\\ \text{`` toothed}\\ \text{`` lobed}\end{array}\right.\\ \text{opposite} \qquad \text{``} \quad \text{``}\end{array}\right.$$

$$\text{Leaves compound}\left\{\begin{array}{l}\text{feather-shaped}\left\{\begin{array}{l}\text{alternate}\\ \text{opposite}\end{array}\right.\\ \text{hand-shaped,} \quad \text{opposite}\end{array}\right.$$

This key leads to groups of genera in which the species are clearly-described. Thus in the first group of "trees with simple leaves, alternate and entire," we find descriptions of *Magnolia acuminata*, *M. glauca*, *M. tripetala*, *Asimina triloba*, *Cercis canadensis*, *Nyssa sylvatica*, *Diospyros virginiana*, *Sassafras officinale*. Then follow those with simple alternate leaves which are toothed on their edges, and so on. Rough outline sketches of the leaves and fruits help the reader to easily identify any tree ordinarily found in the forests. It will be of great value to nurserymen and tree-growers. A good feature of the book is the modern nomenclature which is adopted throughout, while at the same time the old names are given as synonyms.—CHARLES E. BESSEY.

[1] The Trees of Northeastern America. Illustrations from original sketches. By Charles S. Newhall, with an introductory note by Nath. L. Britton, E.M., Ph.D., Columbia College. G. P. Putnam's Sons, New York, 1890. 8 vo., 250 pp.

General Notes.

GEOGRAPHY AND TRAVEL.

Alaska.—Mount St. Elias.—The scientific expedition sent out last spring under the joint auspices of the National Geographic Society and the United States Geological Survey, for the purpose of exploring the region about Mt. St. Elias, Alaska, has returned. Mr. Russell, who organized the expedition and had charge of the work, is now in Washington, and, at the request of the Associated Press, has furnished the following picturesque sketch of the work of his party:

The party consisted of Israel C. Russell, geologist; Mark B. Kerr, topographer, both members of the Geological Survey; E. F. Hosmer, general assistant; and seven camp hands, hired at Seattle, Washington, of whom J. H. Christie was foreman. Owing to uncertain health Mr. Hosmer returned home from the first camp. All arrangements for camping in an unknown country were completed at Seattle early in June, and on the 17th the expedition sailed for Sitka on the steamer *Queen*, one of the excursion boats plying regularly between Puget Sound and Southern Alaska. The voyage to Sitka furnished an opportunity for seeing the fine glaciers of Tanku Inlet and Glacier Bay, thus serving as an introduction to the still more wonderful ice fields about Mount St. Elias. On arriving at Sitka the members of the expedition were transferred at once to the United States steamer *Pinta*, under command of Captain Farenholt, who had previously received instructions from the Secretary of the Navy to take them to Yakutat Bay. The *Pinta* reached the mouth of Yakutat Bay on June 25th. The bay is a broad, deep inlet, extending more than thirty miles inland, and it was the plan of the expedition to begin work near its head on the west shore. The weather being thick, Captain Farenholt did not think it advisable to take the vessel up the bay, and the voyage had to be made by means of boats and canoes in a driving rain storm. The actual base of operations was reached on June 28th, and the study of the geology and geography of the region began at once.

"When the storm passed away," says Mr. Russell, "we found ourselves on a wild shore encumbered by icebergs and at the immediate base of a majestic mountain range, trending southeast and northwest. Along the southern base of the mountains there is a plateau some

thirty miles broad, divided by the waters of Yakutat Bay. Our task was to explore and map the country from the bay to St. Elias, and as far beyond as practicable. Excursions were begun at once to the neighboring mountains and glaciers and up Yakutat Bay as far as the floating ice would allow a canoe to travel. One of these excursions took us to an island at the head of the bay, which we named Grandview Island. From its summit, which rises boldly a thousand feet above the water, a magnificent view was obtained of a vast stretch of snow-clad mountains from which glaciers of great magnitude descended to the sea and ended in cliffs of ice several hundred feet high. From these the icebergs crowding the bay were derived. One of these glaciers we named after Dalton, the pioneer explorer of the region; another, of larger size, at the head of the bay, was named in honor of Gardner Hubbard, the President of the National Geographic Society. A magnificent mountain peak, rising some 10,000 feet immediately above the Hubbard glacier, received the same name. Another towering peak on the same mountain crest, triangular in shape and always of purest white, was named Mount Seattle in acknowledgment of the faithful services of our camp hands, whose homes are mostly in the 'Queen City of the Sound.'

"While glacial and geological studies were being pushed forward, Mr. Kerr measured a base line with considerable accuracy, and began a map of the region. From the ends of the base line sights were taken to several peaks and hill tops near at hand, the angles between the lines of sight and the base line affording data for determining other distances. By means of angles of elevation their heights could also be calculated. The stations whose position and elevation had thus been determined were made the extremities of new base lines from which sights to all the mountains in the region could be made, and the heights of the highest peaks accurately determined. In addition to the 'dip angles,' the heights of the stations occupied were determined by means of a mercurial barometer. To aid in this work, a 'base barometer' was read three times a day during July and August by Rev. Carl J. Hendrickson, who has charge of a mission at Yakutat. From this beginning the work of mapping the country was carried forward until all the peaks to be seen from our line of march were located and their heights determined. Sketches and photographs were taken from many points of view. These, together with the triangulation, will furnish material for an accurate map of the region visited. The map will embrace upwards of a thousand square miles.

"As soon as topographic work was well under way a line of march towards St. Elias was decided upon. All of our rations, bedding, tents, etc., had to be carried or 'packed' by the men, the character of the country not allowing the use of animals. At first the trips from camp to camp had to be repeated several times. Profiting by experience we abandoned everything that was not essential, and as our work progressed we found that many things deemed indispensable at first could be left behind. Our line of march was toward the northwest, with the triangular summit of St. Elias as our guide. Fortune favored us in many ways. We found passes in the mountains leading in the direction we wished to travel, and no insurmountable difficulties in the way, although great patience and judgment were required in treading the net-work of crevasses in the ice fields. Probably more than nine-tenths of the journey was across glaciers and snow fields.

" On the first of August we were midway between Yakutat Bay and St. Elias, but still at the base of the mountains. Our camp was in the last and highest grove of trees that it was practicable to reach. The timber line is there about 1500 feet high, and all trees disappear a few miles to the west. An island of rock surrounded by vast glaciers, but clothed with beautiful flowers, rank ferns, and dense spruce trees, furnished a delightful spot for our base camp. We named this lovely oasis in the desert of ice 'Blossom Island.' From there our work in the high mountains began. On following up Marvin Glacier, which flows to the west of Blossom Island for about fifteen miles, we reached an elevation of 4000 feet, and found an easy pass, although filled with glacial ice, leading westward across what from a distance seemed an impassable mountain range. We named this 'Pinnacle Pass' on account of the tapering spires overlooking it. West of Pinnacle Pass we descended to a glacier that has its source to the north of Mount Cook, and separates the mountain range from the St. Elias range. On crossing this glacier and approaching the mountain wall which rises to the west of it, we again found a pass leading toward St. Elias that afforded an easy path to the Conrad glacier, one branch of which rises on the northern slope of the great mountain. Following up this branch we at last, after twenty days' hard work above snow line, found ourselves encamped at the base of St. Elias. The weather had been clear for ten days and we had every prospect of a good day's climb on the morrow. Rising at three in the morning we began what we believed to be the final ascent, but, after a few hours, storm clouds settled down around us, snow began to fall and all landmarks were lost to view. The snow continued for thirty hours without cessation, and it

was with difficulty that we found our way through the blinding snow to a lower camp, where the necessary rations were to be had. A second attempt was made to reach the summit two days later, but another snow storm broke over the mountain as suddenly as the first. This time I was alone in the highest camp, where I was imprisoned for six days before being able to rejoin my party below, while Mr. Kerr was similarly isolated at the first camp lower down. When I started down there was six feet of new snow, which refused to harden, and rendered it impossible to do more work among the high peaks.

"On descending to a lower level I started on an excursion up the glacier between the St. Elias range and Mount Cook, which gave promise of leading to a low path across the main range, but a third snow storm coming on, I was obliged to return to Blossom Island and there rejoined Mr. Kerr, who had descended a few days previous. My stay above the snow line lasted thirty-five days. During that time we lived in tents, many times camping on the open glacier, so as to be out of the reach of avalanches. All of our cooking was done by means of small coal oil stoves.

"After returning to Blossom Island an excursion was made far out on the great Piedmont glacier, which forms a plateau about 1500 feet high, stretching along the southern base of St. Elias range. This glacier is of continental type and has an area estimated at about 1000 square miles. It is the largest glacier known in the Northern Hemisphere, with the exception of the ice fields of Greenland.

"We returned to Yakutat Bay about the 20th of September, having had stormy weather almost all the time since leaving the vicinity of St. Elias. On the 22d of September our hearts were gladdened by seeing the *Corwin* steaming up the bay. Captain C. L. Cooper, commander of the *Corwin*, acting on his own judgment and knowing that we would have a hard time if left at Yakutat until winter set in, made the cruise from Sitka especially for our relief, and conveyed the expedition to Port Townsend, where we arrived on October 2.

"From the point of view of the scientist, if not of the Alpinist, our expedition was a success. The plan proposed before starting was carried out almost to the letter, so far as the study of glaciers, geology, and topography was concerned, but we did not reach the top of Mount St. Elias. The measurements made have determined that all the mountains in this region are lower than was previously supposed, and that St. Elias, instead of being the highest point in North America, is in reality a second-rate mountain. Its elevation, instead of being 19,500 as previously considered, is about 13,500. Mount Cook has

an elevation of 10,250, and Vancouver 8,500. Many other peaks in the same region are as elevated as Cook and Vancouver, but St. Elias is higher than any of its immediate neighbors.

"The more important glaciers and mountains in the region explored were named principally in remembrance of distinguished American geologists who are no longer living. One grand mountain, some thirty miles northeast of Elias, and probably only second to it in height, was named in honor of Sir William Logan, formerly Director of the Geological Survey of Canada. Several lofty spires to the east of Mount Logan were named after the vessels of the navy and the revenue marine that have become celebrated for their voyages in Behring Sea and the Arctic Ocean."

The results of the expedition will be presented to the National Geographic Society some time in November, and as soon after as practicable will be published by the Society in the "National Geographic Magazine."—*Philadelphia Ledger.*

GEOLOGY AND PALEONTOLOGY.

The Transitional Drift of a Portion of Northern Iowa. —In a paper by the present writer on "The Glacial Drift and Loess of a Portion of the Northern Central Basin of Iowa," [1] which appeared in the NATURALIST a few months since, there was included in the "Upland Drift" an upper silt-like member.

This member was not at that time recognized as a distinct formation, but upon more recent investigations and study is now apparently demonstrated to be. A description of this, we believe heretofore unrecognized, division constitutes the basis of the present paper.

The area here under consideration includes that portion of Northern Iowa lying east of the double moraine, which enters the State from the north; and west of the Loess belt, which borders the Mississippi on the east. This formation is developed over broad areas of surface; and where best developed and most easily defined the contour of the surface is usually of a subdued undulatory type.

[1] In this paper no allusion was intentionally made (except such as became necessary in speaking of the Valley Drift) to the deposits of the glacial epoch, during which the double moraines were formed. In this paper we considered as subdivisions of the "later glacial epoch" both the Loess and Valley Drift. These two formations are, however now shown to represent a subsequent period. The Valley Drift was derived mostly from the materials composing the double moraines, and the Loess appears to mark the highest stage of water during the occupation of the first moraine.

It also sometimes occupies the surface of broad, shallow valleys which are in part filled with Valley Drift.[2] When this occurs, however, it is shown to have been laid down at a period subsequent to that of the upland.

This sheet, as seen developed in the region under consideration, is, for the greater part, of a quite homogeneous silt-like composition, of a grayish-black color, and attains an average thickness of from one to two feet. In places this formation contains well-rounded, smooth, and sometimes striated pebbles of Drift origin, and well-rounded, sometimes angular bowlderettes. At other times neither pebbles nor bowlderettes enter into this formation as component elements.[3]

The three following cuts will give a good idea of the stratigraphical relation which this formation sustains to the subjacent Drift, as well as give a conception of the relative nature of the lithological character of the two divisions.

Figs. 1–3.—Sections of Transitional Drift and Common Drift, illustrating the relative position and lithological character of the two formations.

1. Section in road cut, in gently undulating prairie region, six miles west of Charles City. The upper bed, which is two feet in thickness, represents the Transitional Drift, and is of a fine homogeneous composition, containing, so far as observed, neither pebbles nor bowlderettes. This passes quite abruptly into the underlying gravelly Drift, which is one and one-half feet in thickness. The lower bed (nine inches thick) is fine siliceous sand.

2. Section in road cut, about two miles north from Rockford, and three-fourths of a mile distant and more than one hundred feet (estimated) above the Shellrock River. The higher bed, a little more than two feet in thickness, is Transitional Drift, the lower part of which is slightly yellow, and contains some rounded pebbles. This passes quite rapidly into the coarse Drift gravel below.

3. A general section of the two sheets under consideration. The upper deposit contains some pebbles and bowlderettes, and passes, more or less rapidly, into the underlying Drift or Till. This member

[2] This is well illustrated in Fig. 2 of the above-mentioned paper.

[3] We have observed this sheet well developed in portions of Southeastern Iowa.

appears to be an intermediate or transitional formation (hence the name Transitional Drift which I have applied) between the true Drift below and the Loess, which occupies a chronological horizon above.

If I discern correctly, the Transitional Drift is distinguishable from true Drift (1) by the almost entire absence of clay; (2) the relatively small amount of gravel and bowlders; (3) by the looseness and more homogeneous nature of its earthy base; and (4) by its stratigraphical position and color. It is also distinguished from Loess mainly by its looseness, color, almost absence of clay, and less homogeneous character, as well as by its containing both gravel and bowlderettes.[4]

It is not infrequently the case that the constituent elements composing the true Drift and the Transitional Drift pass into one another with such gradual and imperceptible gradation as to make it impossible to designate just where the division line separating the two formations should be drawn. At other times, however, the line of demarkation or separation between the two sheets is abrupt and sharply defined.

The material of the Transitional Drift is also sometimes seen to so imperceptibly graduate into the Loess as to make it a hopeless task to undertake to indicate just where the line separating the two deposits should be placed.

It is believed that the component elements of this formation were derived mainly from the less coarse material contained within the glacial ice, which material, upon the melting of the ice, was distributed, with more or less uniformity, by its waters over large areas covered by the Drift, which had accumulated under the glacier.

It is manifest, upon consideration, that the finer material held in suspension by the glacial waters would not settle down so soon as the coarser material forming the Transitional Drift, but would be borne along by the more or less rapidly-moving floods, and finally be deposited in the form of sediment as the waters collected and formed into lake-like expansions along the axis of drainage.

This sediment we conceive to be our typical Loess, which we believe to be analogous to the Transitional Drift, only modified by

[4] Prof. Torrell has distinguished a Drift sheet, apparently somewhat similar to this, in the hilly regions of Eastern America (it is also recognized in Sweden), which has been designated " Upper Till."

" It is held to be distinguished from true Till (1) by its looseness; (2) by the usually large size and angular form of its rock fragments; (3) by the more sandy and porous character of the earthy base; and (4) by the higher oxidation of its iron compounds."

" This is regarded as having been the material embraced *within* the glacial ice or borne on its surface, and by its melting let loosely down upon the true Till formed beneath the ice."—*T. C. Chamberlin, U. S. Geological Report, 1881-'82, p. 297.*

repeated washing processes, until it finally reached its present remarkable extent and purity.

The numerous bowlders observed in the region under consideration are thought to belong the Drift, and also to represent in part the coarser blocks held *within* the glacial ice.—CLEMENT L. WEBSTER, *Charles City, Iowa.*

Synopsis of American Carbonic Calyptræidæ. By Charles R. Keys (Proc. Acad. Nat. Sci. Phila., 1890, pp. 150–181).—This paper is a complete résumé of all that is at present known concerning the American Carbonic shells, hitherto commonly referred to Conrad's genus Platyceras. There are also incorporated many new observations derived from an exhaustive study of a large amount of excellent material collected during the past few years, besides an examination of nearly all the types of the different forms. Of a single specimen more than three hundred specimens were obtained from a single locality, for the puposes of determining the limits of variation. While it may be regretted that the familiar name established by Conrad nearly half a century ago is given up, it is thought the change will be a great advantage in the consideration of this group, since it has long been regarded by paleontologists who are familiar with the recent shells that Conrad's group actually formed a part of Capulus of Montfort. The habits of the group are discussed, and the attachment of the shells to Crinoids, by which their change of form is attained, is illustrated with many examples. It must be borne in mind that the relation of the two forms does not imply that the Gastropod was parasitic in its habits, as has been generally regarded, but that the mollusc, though for the greater part of its life stationary, probably fed on the excrement ot the Crinoid. The remarks upon geographic and geologic distribution have a wide application. The relations of the forms from the Burlington and Keokuk rocks are very significant in its bearing upon the true connection of the two formations. All known forms and new ones are fully described, and a plate of twenty-three figures will aid the student in his study of this interesting family.—H. G. GRIFFITH, M.D., *Burlington, Iowa.*

An Extensive Deposit of Phosphorite Rock in Florida.—Prof. E. T. Cox has recently investigated a deposit of this character which extends from Middle to Northern Florida in beds of probably upper Eocene or Vicksburg age, as determined by Prof. Eugene Smith and others. Professor Cox states that "while the Florida phosphate, like apatite, is almost a pure phosphate of lime, yet it differs so widely

from that mineral in its physical characteristics that I have taken the liberty to give it the name of 'Floridite.' It occurs as a rock that had long been mistaken as a limestone, but unlike a bedded limestone it is mostly in segregated masses, some of which will weigh a ton or more. On the Eagle Phosphate Company's property, of which I made a special examination, a shaft was commenced on an outcrop and sunk to the depth of 41½ feet before it reached the bottom of the solid 'Floridite.' In a paper which I read at the Indianapolis meeting of the A. A. A. S. I gave it as my opinion that the Florida phosphate is a mineralization of an ancient guano. It differs entirely from the coprolite and gravel phosphates of the Carolinas, and the Peace River phosphate gravel or conglomerate phosphates that are found in the bed and shores of Peace River, in the southern part of Florida. The 'Floridite,' or rock phosphate, follows the trend of the Gulf of Mexico, and I have traced it from the southern part of Citrus county as far north as Madison in Madison county, and over a width of country fully twenty miles wide. I do not mean to say that it forms a continuous bed over this area, for there are many breaks where small patches only exist. The rock is found in many places cropping out, but is usually covered with from one to ten feet of sand. It is quarried by stripping off the covering of sand and breaking down the phosphate after the manner of quarrying stone.

"'Floridite' will average 80 per cent, of bone phosphate of lime. It is worth in the European market from $25 to $30 per ton, or, 33 to 38 cents per unit.

"I consider the discovery of this phosphate rock, which has heretofore been taken to be a limestone, as one of great importance to Florida and the entire Union, both on account of its commercial value and its stimulus to profitable agriculture."

MINERALOGY AND PETROGRAPHY.[1]

Petrographical News.—The placing of the diabases among the intrusive rocks has for some time seemed a questionable proceeding to many petrographers. They so often occur as flows between sedimentary strata, and frequently apparently as surface flows, that it would appear more logical to place them among the effusives. Brauns[2] has lately described a diabase from Quotshausen in the valley of the Perf,

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.

[2] *Zeits. d. Deutsch. Geol. Ges.* XLI., 1890, p. 491.

a tributary of the upper Lahn, which on its upper surface bears flowage marks like those in modern lavas. A section from this portion of the rock-mass shows a glassy base, dotted with grains of magnetite and mottled with irregularly shaped, doubly refracting areas, without further definite characteristics. Beneath the surface the mottlings resolve themselves into fibrous lath-shaped feldspar crystals, arranged in fluidal lines and extinguishing with a somewhat undulous extinction. The mass between these appears to be homogeneous, but in polarized light it is found to possess aggregate polarization. At a distance of twenty centimetres from its surface the rock consists of well-defined feldspar laths and little grains of augite and altered ilmenite. At 60-100 cm. from this surface it is a typical diabase. The interesting features connected with the occurrence are: 1, the undoubted former existence of the rock magma as a fluid upon the surface, as indicated by the structure of its upper portion and the flowage lines marked by the feldspar crystals; 2, the existence of the typical diabase texture (hypidiomorphic-granular) of the rock at but a little distance beneath its upper surface. The lack of crystals in its upper portion shows that crystallization began only after this part of the magma had come to rest. It was during this period of rest that all the crystallization took place; hence, the author concludes, rest and gradual cooling are the conditions necessary to the assumption of the hypidiomorphic structure. Continuing the subject further, the same writer describes an occurrence of diabase in a flow at Homertshausen, in Nassau. At some distance beneath its upper surface, where crystallization went on gradually, the rock is a normal diabase with an ophitic structure, and possessing no olivine. Nearer the surface it is rich in corroded olivine, poor in augite, and it contains radially divergent feldspar crystals cemented by glass. Nearer to the periphery it is composed of glass, holding crystals of augite and varioles of the composition and structure of diabase (concretions). On the periphery it is a glass with globulites, globosphærites, etc. The minute structure of each of these phases is described in great detail, as is also the effect of the solution of limestone inclusions upon the diabase material surrounding them. In the third[3] division of his paper the author announces that Rosenbusch has decided to place the diabases with the effusive rocks, and then discusses their position in the scheme with respect to other basic effusives. He shows that there is no definiteness in the distinctions between augite-porphyrite, melaphyre, basalt, and diabase. Every definition that is proposed for any one of these rocks breaks down when exam-

[3] Ib., p. 523.

ined critically. He proposes a classification based upon slight differences in structure and appearance, ascribed primarily to differences in the conditions under which the rocks were formed, and consequently upon their geological age. They are divided as follows:

	Paleozoic to Carbon.	Mesozoic to Tert.	Tert. to Recent.
Granular	Diabase	Melaphyre	Basalt
Porphyritic	Diabase-porphyrite	Melaphyre-porphyrite	Basalt-porphyrite
Glassy	Diabase-glass	Melaphyre-glass	Basalt-glass

It is also suggested that further definiteness might be obtained by prefixing the name of the characteristic phenocryst to the second portion of the name of the porphyrites, and to the first part the name of the characteristic mineral not porphyritically developed. Thus olivine-diabase-augite-porphyrite is an olivine diabase containing porphyritic crystals of augite.——Of the two theories proposed for the explanation of the variolite of Durance, the one regards the rock containing the peculiar structure as related in some way to gabbro, the other looks upon it as an endormorphous contact product of diabase Mr. Cole[4] has examined the field relations of the rock, and has come to the conclusion that the variolite is a devitrification product of a spherulitic tachylite occurring occasionally on the sides of diabase dykes, but more frequently on the surfaces of lava flows. According to this view variolite stands in the same relation to the basic lavas as pyromeride does to those of acid character. The author compares the conditions yielding the variolites with those surrounding the Hawaiian lavas. Incidentally he mentions that gabbro is not as abundant a surface rock in the vicinity of Mt. Genévre as has heretofore been supposed. The serpentines of the region he regards as having been derived from some more basic rock than this. The age af the diabases and the associated variolites is supposed to be Postcarboniferous.——Compound spherulites consisting of groups of small spherulites occur in a black obsidian at Hot Springs, in California. The compound body is marked by a divergent structure, which is due to a secondary crystallization set up in the rock after the small spherulites had accumulated at given points to form the compound body. The radiating substance is thought by Mr. Rutley[5] to be orthoclase, crystals of which run uninterruptedly through the smaller spherulites. Mr. Rutley supposes the primitive spherulites to have been formed in the obsidian while it was still

[4] *Quar. Jour. Geol. Soc.*, May, 1890, p. 295.

[5] Ib., Aug., 1890, p. 423.

liquid, and then to have floated around until they aggregated. After the formation of these accumulations they began to crystallize, and this produced the radiating structure. Mr. Iddings, who has also seen the specimens, regards the radiating structure as original and the spherulitic structure as secondary. The bodies, he thinks, are lithophysæ, and not spherulites.——The hornblende-bearing rocks of the Prussian Graftschaft Glantz have been divided into two groups,—the first comprising eruptive syenites, and the second including hornblende schists. Traube[6] believes that the rocks of both groups are but facies of the same mass, but whether eruptive in origin or belonging to the crystalline schist series he is unable to decide. Both the so-called syenites and the hornblende schists consist of orthoclase, quartz, mica, and augite, together with hornblende derived from it. The amount of the hornblende present (all of which is secondary) and of the other constituents varies so widely that intermediate varieties between the two types are quite common. The rock in all cases is an augite-gneiss or a quartz-bearing augite-mica-syenite. From the nature of certain phenomena observed in limestone in contact with the hornblende rocks it is thought possible that these latter are eruptive.——In a very short communication Dr. Hobbs[7] gives an account of the alteration of gabbro into hornblende-gneiss through gabbro-diorite at Ilchester, Md. The change from gabbro into gabbro-diorite is similar in its essentials to that described by Williams in the Baltimore area. The change into gneiss is effected through the granulation of feldspar, the fraying-out of hornblende, and the production of epidote and quartz.——Pilot Knob, a hill seven miles southwest of Austin, Texas, is regarded by Prof. Hill as a Cretaceous volcano. Its material, according to Mr. Kemp,[8] consists of nepheline-basalt, with phenocrysts of olivine and augite in a ground-mass of microlites of augite and grains of magnetite in a nepheline-glass.

Mineralogical News.—*New Minerals.*—Rammelsberg[9] has discovered associated with the eudialyte of Sigterö, near Brevig, in Norway, a new feldspar, which he calls *sigterite.* It has the cleavage of orthoclase. Its extinction against the edge $oP \wedge \infty P\grave{\infty}$ is 16°. On oP two sets of twinning lamellæ make with each other angles of 7°–9°. The extinction of each individual is therefore 3½°–4½°. An analysis, corrected for impurities, gave: $SiO_2=50.27$; $Al_2O_3=$

[6] *Neues. Jahrb. f. Min.*, etc., 1890, I., p. 95.

[7] Trans. Wis. Acad. Sci., etc., VIII., p. 155.

[8] *Amer. Geol.*, Nov., 1890, p. 292.

[9] *Neues. Jahrb. f. Min.*, etc., 1890, II., p. 71.

30.75; Na_2O=14.24; K_2O=4.73. This corresponds to $(NaK)_2Al_2Si_3O_{10}$, which according to the Rammelsberg view is $(NaK)_2Al_2(SiO_3)_4+(NaK)_2Al_2(SiO_4)_2$. By doubling the formula it becomes a combination of albite and an alkaline anorthite, with nearly the composition of anhydrous natrolite. The new mineral is, consequently, a very basic alkaline feldspar, related to albite as follows: Albite = $R_2Al_2Si_6O_{16}$; sigterite = $R_2Al_2Si_3O_{10}$.——*Quetedite*, from the Salvador mine in Quetena, Chili, is a reddish-brown, translucent to opaque mineral, with a slightly waxy lustre. Its hardness is 3, and density 2.08–2.14. It occurs[10] massive, associated with copper vitriol, and in prismatic monoclinic or triclinic crystals in the latter mineral. Its analysis gave:

$$SO_3=37.37;\ Fe_2O_3=22.70;\ MgO=5.92;\ H_2O=34.01$$
$$=Fe_2S_2O_9+MgSO_4+13H_2O.$$

——*Gordaite* accompanies sideronatrite from Sierra Gorda, near Caracoles, in Chili, as one of a number of thin coatings covering this mineral.[10] It is glassy, transparent, and forms short, broadly-tabular pieces and crystals, or fibrous masses of a white to light gray color. Its hardness is 2.5–3, and specfic gravity 2.61. The crystals are triclinic prisms with their lateral faces vertically striated. The mineral forms the end member of a series of hydrous iron-sodium sulphates, of which sideronatrite, with but a small proportion of sodium, is the other end member. The composition of gordaite (SO_3=50.85; Fe_2O_3=19.42; Na_2O=22.36; H_2O=7.33) corresponds to $Fe_2S_2O_9+3Na_2SO_4+3H_2O$.——*Tamarugite*, from Tarapaca, Chili, is described by Schultze[11] as a massive, colorless, radiated mineral, with a hardness of 2, and a density of 2.03. In composition it differs from soda alum in its percentage of water, as indicated by the formula $Na_2SO_4+Al_2(SO_4)_3+12H_2O$.——*Ciplite* is a phosilicate of calcium occurring in the chalk of Ciply, in France.[12]

General.—Up to the temperature of 570° *quartz* crystals expand rapidly, both parallel and perpendicular to the vertical axis, and at this temperature become fissured. Above this temperature quartz expands very slightly, in some cases even appearing to contract.[13] Between 560° and 580° sections perpendicular to *c* become doubly refractive. The double refraction increases rapidly below 570°, and above this

[10] Frenzel. *Min. u. Petrog. Mittheil*, 1890, XI., p. 217.

[11] Verh. d. Ver. Santiago, 1889. Ref. *Neues Jahrb. f. Min.*, etc, 1890, I., 258.

[12] Ortlier: Ann. Soc. gèol. du Nord., XVI., 1888–89, p. 270. Ref. Bull. Soc. Franc. d. Min., 1890, XIII., p. 160.

[13] Le Chatelier. Bull. Soc. Franc. d. Min., 1890, p. 112.

temperature remains nearly constant. The birefringence [14] is also subjected to a sudden change at this temperature. Other experiments to be made in this same line will undoubtedly show that 570° is a critical temperature for the mineral, above which it loses its characteristic properties.——Cleavages parallel to R and —R, and less perfect ones parallel to ∞P and oP, have been detected by Mallard [16] in thin plates of quartz. The discovery confirms the suspicion that the mineral possesses obscure cleavages, usually noticeable only when fragments of it are heated and plunged into cold water.——In an article in a recent Bulletin of the U. S. Geological Survey, Mr. Hillebrand [17] gives the results of analyses of some rare zirconium minerals found in the granitic debris of Devil's Head Mountain, Douglas Co., Colo. He also records the analysis of a white *beryl* from the gangue of a cassiterite vein at Winslow, Me. The composition of the beryl is:

SiO_2	TiO_2	Al_2O_3	Fe_2O_3	BeO	MgO	$(KCs)_2O$	Na_2O	Li_2O	H_2O	Sp. Gr.
65.21	tr.	18.50	.33	13.03	.09	.14	.87	.16	1.80	2.707

——Although specimens of *tyrolite* recently obtained at the Mammoth Mine, Utah, are sufficiently well crystallized to afford Prof. E. S. Dana [18] data for the determination of the ratio between their lateral axes, it has not been possible to decide upon their chemical composition. The crystals are in flat tables, united into fan-like groups. They are orthorhombic, with their optical axes in the brachypinacoid. Their double refraction is negative and $a:b = .9325:1$. An analysis by Mr. Hillebrand yielded:

CuO	CaO	As_2O_5	H_2O	SO_3	Fe_2O_3	Ins.
45.08	6.78	28.52	17.21	2.23	.08	.16

But this is not capable of representation by a rational formula.——The characteristics of *polycrase* have been defined with some accuracy by Messrs. Hidden and Mackintosh.[19] The material investigated was obtained in the zircon region in Henderson Co., N. C., and from the Upper Salida River, S. C. The mineral occurs in rough crystals bounded by $\infty P\breve{3}$, $P\breve{\infty}$, $2P\breve{\infty}$, $P\breve{3}$, and $\frac{1}{3}P\bar{\infty}$, the latter new to the

[14] Ib., p. 119.

[15] Ib., p. 123.

[16] Ib., p. 61.

[17] Bull. No. 55, pp. 48–55.

[18] *Amer. Jour. Sci.*, Apr., 1890, p. 271.

[19] *Amer. Jour. Sci.*, Apr., 1890, p. 302.

species. It is black on a fresh fracture, and has a brownish-yellow translucency on thin edges. It has a density of 4.925–5.038, a hardness of 5.5, and a light yellowish-brown streak. On exposed surfaces it alters to a lemon-yellow *gummite*, with a density 3.354, and hardness 3.5. An analysis of the crystals from South Carolina gave:

$Cb_2O_5.Ta_2O_5.TiO_2$	Y_2O_3etc.	PbO	FeO	Fe_2O_3	UO_3	CaO	H_2O
47.88	21.23	.46	2.47	.18	19.47	.68	4.46

Ins.	SiO_2	F
.12	1.01	und.

The authors call attention to the fact that the mineral is the first representative of the columbo-titanates in America.——The rare mineral *eukairite* has been found in Villa Argentinia, Prov. Rioja, Argentine, and at several localities in the Andes, associated with calcite, bornite, and other sulphides of copper. It crystallizes in cubic forms (not necessarily regularly), and has a density of 7.641–7.661, and a composition, according to Otto,[20] as follows: Ag = 42.7; Cu = 25.5; Se = 31.5. In general appearance it is like galena.——Lacroix[21] describes the optical properties of quite a numer of *crocidolites*, and concludes that the mineral is a variety of hornblende very widely spread through rocks of various kinds. It may be distinguished from glaucophane by its positive double refraction on basal sections, and its negative refraction in elongated sections.——After analyzing a large suite of *wads* and *psilomelanes*, Gorgeu[22] is inclined to regard them as manganites of various bases, corresponding approximately to the formulas $3(MnO_2)RO + 1\text{-}3H_2O$. Among the wads examined were a few quite well crystallized.——Four crystals of *orthoclase* from the porphyritic granite of the Fichtelgebirg are described by Müller[23] as interpenetration twins, in which each individual is elongated in the direction of its *a* axis. Their oP faces are in the same plane, so that their combination is × - shaped, with the twinning plane a hemi-pyramid.——Laspeyres[24] suggests that the ground-form of *biotite* be made to correspond with that of clinochlore, so that the isomorphism of the two minerals may be made more apparent.——Messrs. Clarke and Schneider[25] have shown experimentally that the *talc* from Hunter's Mill, Fairfax Co.,

[20] Ber. d. deutsch. chem. Ges., XXIII., 1890, p. 1039.

[21] Bull. Soc. Fran. d. Min., 1890, p. 15.

[22] Ib., p. 21.

[23] *Zeits. f. Kryst.*, XVII., 1890, p. 484.

[24] *Zeits. f. Kryst.*, XVII., p. 541.

[25] Ber. d. deutsch. chem. Gesel., XXIII., p. 1537.

Va., comports itself more like a meta-silicate than like a basic pyro-silicate. They therefore decide against Groth's formula for this mineral, and propose instead the formula $H_2Mg_3(SiO_3)_4$.——Crystals of *sulphur* containing twenty-one forms line clefts in galena at Bassick. Their axial ratio is $a:b:c = .8151:1:1.9066$. Busz,[26] who describes these sulphur crystals, describes also in the same article a *beryl* crystal from St. Piero, Elba, *fluorspar* and *göthite* from Cornwall, *hypersthene* from Monte Doré, and *corundum* from Lake Laach.——*Bucklandite* from the Pfitschthal, Tyrol, and *epidote* crystals from Oberhollersbachthal in Pinzgau, and from Floss in Bavaria, have been examined crystallographically by Brugnatelli.[27]——*Pyrophysalite* occurring in a granite dyke at Finibo in Sweden, *augite* from Risoe in Sweden, and *martite* from an iron mine in Ypanema, Saŏ Paulo Province in Brazil, have been briefly described by Kenngott.[28]——The composition of *arsenopyrite*,[29] from Goldkronach and from Neusorg in the Fechtelgebirge is:

	S	As	Sb	Fe	Ni	Co	Ag	Sp. Gr.
Goldk.	20.84	41.36	3.73	34.07			.002	6.09
Neusorg.	17.27	42.89		34.64	4.38	tr.		5.96

——*Chalcocite*[29] from the Kathrina mine near Innsbach, in the Bavarian Pfalz, contains:

Cu	Fe	As	S	Co and Ag	Sp. Gr.
78.44	.93	1.22	20.13	tr.	5.68

——*Minium* from Leadville, thought by Mr. Hawkins[30] to be a pseudomorph after galena, has been examined with the following result:

Pb_3O_4	Fe_2O_3	V_2O_5	Insol.	Sp. Gr.	Hardness.
91.39	.80	.52	7.51	4.57	2.5

——Mr. Seamon[31] thinks that the *calamine* of Missouri was produced by segregation from zinciferous clays formed by the reaction between zinc sulphide and hot silicious waters.——Baumhaur's[32] recent investigations on *apatite* crystals from various localities affirm the statement that the density and axial ratio of this mineral increase with the decrease of chlorine in its composition.——In a short communication

[26] *Zeits. f. Kryst.*, XVII., p. 549.
[27] Ib., XVII., p. 529.
[28] *Neues Jahrb. f. Min.*, etc., 1890, I., p. 87.
[29] Sandberger. Ib., 1890, p. 99.
[30] *Amer. Jour. Sci.*, Jan., 1890, p 42.
[31] Ib., 1890, p. 39.
[32] *Zeits. f. Kryst.*, XVIII., 1890, p 31.

Miers[33] shows that *stephanite* is not hemihedral, but that its crystals are usually twinned hemimorphic forms.——Brief descriptions of *cerussite*, *anglesite*, and *calcite* crystals from the Diepenlinchen Mine, near Stolberg, are given by Dannenberg.[34]——*Phenacite* and *topaz*, the latter altering into *damourite*, occur at Amelia Court House, Va. On the former mineral from Hebron, Me., Mr. Yeates[35] has discovered the basal plane.——Prof. Dana[36] finds that the barium sulphate from Perkin's Mills, Templeton, Can., described by Lacroix as a monoclinic dimorph of barite under the name *michel-levyte*, is really orthorhombic, and therefore true *barite*, and that the peculiar striations observed on it are probably due to pressure.——Minute crystals of *jarosite* line cavities in a siliceous *limonite* at the Mammoth Mine, Utah.[37]——*Thenardite*, *glauberite*, and *calcium carbonate* pseudomorphs of the last-named mineral form thick deposits in a lake-like depression in the Verde Valley, Ariz. Mr. Blake,[38] to whom we owe this knowledge, mentions also the existence of *bournonite* at the Bogg's Mine, Yavipai (?) Co., in the same State.——Heddle[39] declares that *brinachite* of Wallace,[40] occurring in veins in a conglomerate in Inverneshire, is fluorite.——The same author[41] has made a very superficial examination of two crystals of *gyrolite* from the Freshinish Islands, near Mull, England, and pronounces them probably monoclinic.——Solly records his measurements of *struvite* crystals formed by micro-organisms in gelatine culture tubes.

Miscellaneous.—Messrs. Gattermann and Ritschke,[42] in their work on Azoxyphenolether, have obtained a substance which they call anisolazoxyphenetol. This substance, though liquid, appears to possess many of the characteristics of crystals. Its drops are doubly refractive and dichroic.——In a very interesting communication Rinne[43] shows that the oxides of the metals are isomorphous with their corresponding sulphides, a view that is in perfect harmony with the chemical relations existing between oxygen and sulphur. The minerals thus thought to be isomorphous are zincite and wurtzite, valentinite and

[33] Ib., XVIII., p. 68.
[34] Ib., XVIII., p. 64.
[35] *Amer. Jour. Sci.*, Apr., 1890, p. 325.
[36] *Amer. Jour. Sci.*, Jan., 1890, p. 61.
[37] Genth. Ib., p. 73.
[38] Ib., 1890, p. 43.
[39] *Miner. Mag.*, Oct. 1889, p. 272.
[40] Ib., 1887, p. 42.
[41] Ib.,1889, p. 279.
[42] Ber. d. deutsch. chem. Ges., 1890, p. 1738.
[43] *Zeits. d. deutsch. geol. Ges.*, XLII., 1890, p. 62.

stibnite, manufactured bismuth oxide and bismuthinite. The following groups are also thought to be isomorphous, since they occur in isomorphous compounds: CdO and CdS, MnO and MnS, and FeO and FeS.——Mr. Dudley[44] describes pseudomorphs of vivianite after roots of coniferous plants, from the clay banks of the Cumberland River, ten miles above Eddyville, Ky.——In a short note Wulff[45] suggests a method by which plane angles may be measured under the microscope when the apex af the angle cannot be seen, and when its two sides cannot be brought into the field of view at once.——Mr. Brünnel,[46] of the firm of Voight & Hochgesang, has invented a heating apparatus, attachable to any microscope, for use in mineralogical investigations.

New Books, etc.—The ninth annual report of the State Mineralogist of California contains statistics of the mineral products of the State for the year 1889, and accounts of the geology of the mining districts.[47]——The Mineral Resources[48] of the United States for 1888, though late in appearing, is as welcome an addition to mineralogical literature as any of its predecessors have been. The wealth of information within the 630 pages of the present volume defies abstraction. The value of the metallic products of the country for the year in review exceeded the value of those mined in 1887 by about six millions of dollars; while the non-metallic products were larger by seventy-two millions than those of the preceding year. The totals for 1888 are: Metallic products, $256,257,517; non-metallic products, $322,293,159; unspecified, $6,000,000; grand total, $584,550,676. Of especial scientific interest is the description of the occurrence and association of the tin ore of the Black Hills, Dak.——The third part of Hintze's Mineralogy,[49] which has but recently appeared, concludes the tourmaline group of minerals and takes up the humite, helvine, melanocerite, and other groups of rare silicates, as well as dioptase, staurolite, bementite, prehnite, and individual minerals of less common occurrence.

[44] *Am. Jour. Sci.*, Aug., 1890, p. 120.

[45] *Zeits. f. Kryst.*, XVIII., p. 277.

[46] *Neues Jahrb. f. Min.*, etc., 1890, II., p. 87.

[47] Wm. Ireland. Ninth Ann. Rep. of the State Mineralogist for 1889. Cal. State Miner. Bureau, Sacramento, Cal.

[48] D. T. Day. Mineral Resources of the United States for 1888. Washington Govt. Print. Office, 1890.

[49] Leipzig. Veit & Co., 1890, pp. 321–480, 79 Fig.

BOTANY.

An Old Botanical Letter.—In a copy of Persoon's "Synopsis Methodica Fungorum," recently purchased of a London bookseller for the botanical library of the University of Nebraska, the autograph letter given below was found. It was probably addressed to Sowerby, the author of the "English Fungi" alluded to in the first paragraph. The letter is given *verbatim et literatim :*

DEAR FRIEND,

At last I have the pleasure to send You my Synopsis fungorum, You desired to have long ago. I wish You may not be disappointed in Your expectation of it. You'll find many of the species You have published in Your English fungi. I have had the confidence in the justness of Your representations that I have made the descriptions according to them ; if I have been mistaken in this proceeding, I beg You to instruct me of it by a letter.

You have received sometime since several letters and parcels from me, without my having the pleasure to receive an answer from You. I believe therefore to be intitled to give You a gentle reproof for it. However You may make amends for it by writing me soon, particularly if You joined to the letter a good quantity of plants principally cryptogame ones. I remain with esteem and friendship

Sir

Gottingue, May 2, You mosobedient servant

1801. C. H. PERSOON.

The last sentence is marvelously like those written by botanists to-day. How many of us are wont to forgive our tardy correspondents on the same terms, even to specifying "principally cryptogame ones."—CHARLES E. BESSEY.

The Host-Index of the Fungi of the United States.—Part II. of this exceedingly useful publication has just appeared, extending the index through the Gamopetalæ and Apetalæ. The authors—Professor W. G. Farlow and Mr. A. B. Seymour—state that the remainder of the work will appear in November of the present year. They request that "botanists having errors or omissions to report in the parts already issued would kindly inform them regarding such errors and omissions at an early date, in order that the corrections and additions may be inserted in the forthcoming third part."

For the benefit of those who have not seen this work we may say that it is a systematic list of the Phanerogams which are affected by

fungi. All the fungi known to affect each species are given, making in some cases a long list; as, for example, in the beech (*Fagus ferruginea*), which has 103; the white oak (*Quercus alba*), 90: the buttonwood (*Platanus occidentalis*), 37; the white elm (*Ulmus americana*), 24; the white ash (*Fraxinus americana*), 31; the sassafras (*Sassafras officinale*), 42. It would be an interesting inquiry to investigate the relation between the structure and habits of the hosts and the number of fungi which live upon them. A casual examination appears to show that those species which are most widely distributed are most affected by fungi. Woody plants appear to be somewhat more troubled than are their herbaceous relatives, and there seem to be more upon large plants than upon small ones.—CHARLES E. BESSEY.

Some Bad Station Botany.—The experiment stations have in the main been fortunate in their botanical publications, and very little has gone out from them which is misleading or unscientific. Now and then a worker in one line steps over into that belonging to some one else, and then the results are not so satisfactory. We have before us a good illustration of this in a recent bulletin from the Ohio station, in which the agriculturist discusses "Smut in Wheat," meaning thereby the so-called "stinking smut" of the genus Tilletia. After quoting Professor Henslow as the authority for the remarkable (?) fact that "the spores have been accurately measured, and the diameter found to be one sixteen-hundredth of an inch" (as if any freshman in a botanical laboratory couldn't have measured the Ohio spores!), he quotes some calculations as to the number of spores in a single grain of wheat, and the still more remarkable statement "that it is hardly possible to conjecture how many sporules each spore contains, since they are scarcely distinguishable under very high power of the microscope." This last is about as bad as the usual newspaper science, but we certainly expected something better in an article from a station worker. This is not agricultural science; it is sheer ignorance.—CHARLES E. BESSEY.

Wheat Smut.—In pleasing contrast to the work done in some experiment stations is that by Professor Kellerman and Mr. Swingle, of the botanical department of the Kansas station. A recent bulletin on the fungicides for stinking smut of wheat is a model of good work. It is modestly called a "preliminary" report, but the subject is as well wrought out as in most so-called "final" reports.

After a brief but most excellent statement of the main points in the life-history of the fungus, the details of a number of experiments are given, the object of which was to prevent the smut by treatment of the seed before planting. Fifty-one different treatments were used with

varying results. Of these, three prevented the smut entirely, although injuring the vitality of the wheat to a certain extent. Six other treatments reduced the smut to less than one per cent. The three first mentioned were (1) soaking for twenty-four hours in a five per cent. solution of copper sulphate; (2) soaking for thirty-six hours in Bordeaux mixture (copper sulphate two and two-third lbs., lime five lbs., water four gal.); (3) soaking for twenty hours in a five per cent. solution of potassium bichromate. Of the six treatments which effected a reduction of the smut to less than one per cent., that in which the seed was soaked for fifteen minutes in water at a temperature of 132 degrees Fahrenheit was the simplest, and, all things considered, the best. The investigators give it their approval for general use.—CHARLES E. BESSEY.

A Key to the Mosses.—Professor Charles R. Barnes, of Madison, Wis., has done a good thing for the students of mosses by preparing a handy key to the genera and species found described in Lesquereux and James's "Manual." A somewhat hasty examination of it indicates that it is well calculated to aid the beginner. Copies may be obtained of the author for fifty cents each.

Reserve Food-Materials in Buds and Surrounding Parts.—Professor Halsted's paper on this topic, published in the Memoirs of the Torrey Botanical Club, is a valuable contribution to our knowledge of the nutrition of the shoot in early spring. He takes up in order terminal buds, lateral buds, and twig sections. Naturally the most important reserve material was found to be starch, and its distribution occupies the greater part of the paper. It is found quite generally at a short distance below the growing point. Grape sugar is present in all terminal buds. Other cell-contents are discussed in the paper, and the suggestive fact is recorded that crystals "are especially numerous in the cellular tissue that lies between the leaf scar and the bud above it." They are abundant also "just below the growing tips of all buds."

In the study of twigs several interesting and unexpected things come out, as, for example, the fact that the spines found upon many trees and shrubs are more or less well filled with starch. As to these the author makes the following remark: "It is very likely that the spines are primarily for the warding off of enemies, but if we can look upon the protective organs as serving another purpose, it adds further dignity to the police department, so to speak, of the plant." A couple of pages are given to methods and reagents, and two plates serve to illustrate the histology of the paper.

North American Species of Tylostoma.—Mr. A. P. Morgan, in continuing his papers on the North American Fungi, has made a revision of the species of the genus Tylostoma, one of the stalked puff-balls. He recognizes five species, two of which are new. The species fall under two sections, viz.: (1) Cyclostoma, with circular, entire mouth, containing *T. mammosum* Mich. and *T. verrucosum* Morgan; and (2) Schizostoma, with irregular, lacerate mouth, containing *T. fimbriatum* Fr., *T. campestre* Morgan, and *T. meyenianum* Kl. All the species are illustrated by good figures.

Watson's Contributions to American Botany.—Contribution XVII., issued September 25, consists of miscellaneous notes upon North American plants, and descriptions of new species from Northern Mexico. In the first a synopsis of the known species of Streptanthus is given, twenty-two species being recognized, three of which are described for the first time.

Dr. Watson reviews the question of the synonymy of *Andropogon furcatus* Muhl., and says that Lamarck's species, *A. provincialis*, "was based upon what was said to be a grass of Provence, in Southern France." This was in 1783. Gerard, in 1761 figured and described the same grass. Both Gerard and Lamarck cite synonyms belonging in part to *A. ischæmum*. Both descriptions and figures agree best with the *A. furcatus* of Muhlenberg, which appears to have been grown in some of the gardens of Europe at or before Lamarck's time. "It is highly probable, therefore, that the original *A. provincialis*, aside from its synonymy, and *A. furcatus* are the same species." However, Dr. Watson urges that Muhlenberg's name should be retained; the other, he says, "is a false name, and it cannot be justifiable to make a change for the sake of reviving and perpetuating an error."

A new genus of Rutaceæ (Sargentia) is characterized, and one species (*S. greggii*) described, from material collected by Mr. Pringle in Northern Mexico. Two other new genera are characterized, viz., Rhodosciadium (Umbelliferæ), and Jaliscoa (Compositæ, Eupatoriaceæ).—CHARLES E. BESSEY.

New North American Fungi.—Under this title J. B. Ellis and B. M. Everhart describe a large number of fungi, in the Proceedings of the Academy of Natural Sciences of Philadelphia. Nearly all are Ascomycetes, the genera Valsa, Diatrype, Sphærella, Leptosphæria, Cucurbitaria, Nectria, Plowrightia, and others being represented. Two new species of the last-named genus are described, viz., *P. staphylina*, on Staphylea, from London, Canada, and *P. symphoricarpi*, on *Symphoricarpus occidentalis*, from Montana.

ZOOLOGY.

Fresh-Water Sponges.—Maas[1] has studied the fresh-water sponge in Berlin. He describes the segmentation of the egg and the process of formation of the germ-layers. The latter exhibits some similarity to gastrulation in its broader features, and results in the formation of a closed cavity at one end of the oral germ. From the seemingly similar cells of this germ the ecto- meso- and entoderm are developed. The ectoderm is at first distinctly columnar. The mesoderm cells soon acquire a distinctly mesenchymal shape, and begin the formation of spicules before the appearance of the ampullæ. The entoderm appears to develop from the lining cells of the cavity of the germ, and consists of a flattened epithelium connecting here and there with globular anlage of the ciliated chambers. These latter sink further into the mesoderm, the flattened epithelium becoming drawn out to form efferent canals. The efferent openings are produced by a thinning of the ectoderm and a final breaking through. Maas did not see the process of formation of the osculum. Soon after the differentiation of the germ-layers the embryo (which has previously led a free life) loses its cilia and settles down, at the same time becoming flattened into a thin sheet. Connected with this, the ectoderm loses its columnar character and becomes flattened. Maas gives more proof —if more was needed—that Götte was wrong when he said that Spongilla loses its ectoderm during the process of development.

Notes on Earthworms.—In a paper,[2] devoted chiefly to descriptions of genera and species, Mr. F. E. Beddard prints some interesting points concerning earthworms. *Perichæta indica* is recorded from South America; it was previously known from the East Indies and New Caledonia. Perichæta, from its distribution, from its nephridial system and its circles of chætæ (Lankester's restriction of the term setæ is advisable), is regarded as the more primitive, and the bunches of chætæ in other earthworms are derived from this, rather than from the parapodia of some Polychæta. In the posterior part of the body of *Perichæta indica* are peculiar glands attached to the posterior sides of the septa on either side of the dorsal vessel. Somewhat similar septal glands occur in Acanthodrilus. Chemical tests seem to show the presence of glycogen in these

[1] *Zeit. Wiss. Zool.*, L. Heft 4.

[2] Proc. Zool. Socy. London, 1890, p. 52.

organs,—and this in the epithelial cells, and not in the muscles as Barfurth thought. It also occurs in less quantity in the other peritoneal cells.

Teredos in Telegraph Cables.—At a recent meeting of the Zoological Society of London attention was called to the fact that Teredos caused no little trouble to the managers of submarine cables off the Brazilian coast. These molluscs penetrate between the sheathing wires when in the embryonic stage, and then bore into the tanned jute, and even scoop out pieces from the gutta-percha sheathing of the conductor. Faults made by these Teredos are very difficult to locate, as they leave no external sign.

Scarcity of Oysters.—Owing to overdredging the oyster supply of the Chesapeake will be very small during the coming winter. The packing houses in Baltimore are finding it difficult to obtain supplies sufficient to keep them going at the rate of last winter. In 1888 and 1889 it was not unusual for the canning houses to steam 50,000 bushels a day, but this year the supply is at least fifty per cent. less. It does not need much of a prophet to point out that if the present overdredging be kept up for a few years longer the supply of Chesapeake oysters will be a thing of the past.

Hermaphroditic Anlage in Insects.—A very interesting and important article on the hermaphroditic anlage of sexual glands in *Phyllodromia* (*Blatta* L.) *germanica* has recently been published by Herr R. Heymons in the *Zoologischer Anzeiger*, August, 1890. The article contains only the most important results of Herr Heymons's investigations, which are to be published later in full. The investigations were carried on in the Berlin Zoological Institute, under the direction of Prof. F. E. Schulze, of Spongia fame.

Herr Heymons undertook to work out as carefully as possible the development of the sexual glands; and in the present incomplete state of our knowledge as to the origin and growth of these glands in insects such extended study with the aid of modern technic is very welcome. The first appearance of the sexual glands is of particular interest. Herr Heymons observed that the sexual cells have their origin chiefly in the walls of the cœlomic sacs. A smaller portion arises from the unsegmented mesoblastic layer, at a period before the primitive segments make their appearance. The author is undoubtedly correct in regarding this origin of the sexual cells from the walls of the body-cavity as an extremely primitive relation. It is interesting to note the correspondence with lower forms. In the Annelids, *e.g.*, the genital

cells are also modified epithelial cells of the body-cavity, and this agreement adds unquestioned weight to the opinion that the insects stand in phylogenetic connection with the Annelids.

The genital anlage takes its origin from these genital cells together with certain smaller ones,—the "epethelial" cells of the entomologists. It is elongated and paired in both sexes, and lies either side of the intestine; the numerous egg-tubes which comprise the ovary of the female arise from these two cell-strands. With regard to the parts composing the ovarian tubes Herr Heymons does not agree with former authors. He states that the epithelial are of an entirely different origin from the eggs, whereas they were hitherto held to be of like origin,—at first an undifferentiated mass of cells, which afterwards gradually separate into egg and epithelial cells; and while the whole genital anlage of the females goes to form the ovarium, only a portion of the same is used in the male to build the testes. According to the investigations of Herr Heymons the origin of the sexual glands is alike in the male to that of the female already described: the two lateral cell-bands are formed, each of which is held in place by an "endfaden-platte." Both genital and epithelial cells are present. A large number of the latter lie on the ventral side of the organ, and give rise to the vas deferens. At a particular stage of the development the genital cells of the male group themselves at four points. These are first rudiments of the four follicles which compose each testis. Each genital anlange now contains two portions: (1) the four follicles, and (2) the genital and epithelial cells, which did not enter into the composition of the first, bût which can be clearly seen between them. The follicles are connected with the vas deferens, which becomes shorter, and thus draws them out of the mass. The above-mentioned cells which were between the follicles are held in position by the "end-fadenplatte," and represent, as Herr Heymons has most conclusively shown, *the rudiment of a female genital gland.* The further development of this organ is very variable in different individuals; details may be found in the paper itself. Of special interest is the fact that Herr Heymons found some cases in which the males possessed typical ovarian tubes with eggs and follicle, and that these were developed near the testes follicles. According to this the anlage of the male genital glands in the Phyllodromia must be regarded as hermaphroditic.

As the roaches are among the simplest and earliest insects, Herr Heymons draws the conclusion that the latter are probably descended from hermaphroditic forms.

Further particulars on the above-reviewed "preliminary," and of Herr Heymons's other investigations in this line, will be looked for with considerable interest.—C. W. STILES, *Leipzig, October, 1890.*

Studies on the Wrist and Ankle.—Dr. C. Emery[1] starts with Gegenbaur's morphological principle that the centrale must have had a primitively central position, and that where several centralia are present they form a connected group; but he rejects the views of Howes and Ridewood[2] that there may be a translocation of centralia to the radial and ulnar sides of the hand. He further accepts the views of Götle and Leboucq regarding the rays of the carpal and tarsal members. First he shows that in the hand of the larva of *Rana esculenta* traces of an intermedium are visible, and that the so-called centrale is a true centrale. Next he attacks the problem of the true nature of the so-called naviculare in the Anura. Comparing the carpus and tarsus of a frog, the similarity of the navicularia in both is apparent, but the naviculare tarsi is apparently, as Wiedersheim has pointed out, the tarsale of the prehallux; hence, says Emery, the so-called thumb of the frog must be a prepollex, or otherwise the prehallux must be hallux, and then the last fibular toe would be post minimus. He holds the former view. A larva of Pelobates with six toes is regarded as settling this point.

From this he turns to the existence of the prepollex in the Mammalia, and to Bardeleben's recent paper[3] on the foot of Pedetes. Similar bones to those described by Bardeleben as elements of the prepollex are known in other mammals, especially in the Rodentia. In other cases these structures are apparently ossifications of tendons. In the embryo of a rabbit Emery finds a true prepollex developed entirely independently of the fascia palmaris. This later migrates to the volar surface of the manus. This prepollex shows as many similarities with that of the Anura that Emery is not in doubt of their homology. Emery, however, regards the nail described by Bardeleben[4] on the prepollex of Pedetes as merely a horny growth. Bardeleben in turn[5] reaffirms his original statement, and quotes from a letter by Kohlbrugge, in which three specimens are mentioned with a true nail on this digit and a fourth with a horny cup. He also supports Bardeleben in his view of two phalanges in the prepollex of Pedetes.

[1] *Anat. Anz.*, V., 283.

[2] Proc. Zool. Socy. London, 1888.

[3] Proc. Zool. Socy. London, 1889.

[4] *l. c.*

[5] *Anat. Anz.*, V., p. 321, 1890.

Skull of Sharks.—P. J. White has an account of the skull and visceral skeleton of the Greenland shark (*Læmargus microcephalus*) in the *Anatomischer Anzeiger*, V., No. 9. The cartilage is soft, and, except in the visceral arches, is without calcareous deposits. Among the peculiarities are the following: The neural arch of the first vertebra freely enters the foramen magnum; a canal (hypophysis canal?) runs through the cranial floor, opening near the foot of the pituitary fossa; a median cartilage intervenes between the extremities of the mandibular rami; there are other cartilages which may represent hypohyal elements; the first basibranchial is present,—it had only been known in Cestracion of the Elasmobranchs.

Dr. Leonard Stejneger on Bufo lentiginosus woodhousei.—In *Animal Life*, No. 3, p. 116, 1890, Dr. Stejneger, who is in charge of the department of reptiles in the Smithsonian Institution, writes as follows: "Prof. Cope, in his elaborate work on the 'Batrachia of North America,' as a reason for leaving Hallowell's *B. dorsalis* out of the synonymy, makes the following statement: 'There is nothing in the description nor the figure to enable us to ascertain what species or subspecies is represented. The evidence is as much in favor of the specimen having been a *B. l. americanus* as a *B. l. woodhousei*, and no locality is given to assist in reaching a conclusion.' This not so, for in the first place Hallowell gives the locality of the only specimen expressly as 'San Francisco Mountain, New Mexico' (*i.e.*, Arizona), and the second place mention is made of the shortness of the head ('Length of head, 8 lines; length of head and body, 3 inches,' consequently 'head 4.5 times in length'). Moreover, Girard, who afterwards examined and partly described the type specimen, simply changed the name because *B. dorsalis* was already preoccupied by Spix, and we are well warranted in regarding the only specimen brought home by Dr. Woodhouse as the type of *B. woodhousei.* Finally, the type of *B. dorsalis*, so far from not being found, is one of the very specimens enumerated by Prof. Cope, viz., No. 2531. The 'Calif Mountains' in the original entry on the museum record book is simply a slip for San Francisco Mountain, and is evidenced by the original parchment label still attached to the specimen, which reads: '*Bufo dorsalis*, Hallowell, San Francisco Mountain, New Mexico; S. W. Woodhouse, M.D.' This also disposes of another statement by the same author, that Möllhausen's specimen from the Canadian River (U. S. Nat. Mus., No. 2632) is the type. Girard at the time of publishing the name *B. woodhousei* had only the 'Sonoran' specimens from

the U. S. Boundary Survey and Hallowell's type of *B. dorsalis;* those from the Pacific R. R. Survey under Whipple came in later."

These statements imply a good deal of error somewhere, and it now devolves upon me show where it lies. In the first place, my statements as to the absence of anything "in the description or figure to enable us to ascertain what species or subspecies is represented" are strictly correct. As the character of the *B. l. woodhousei* is to have the head 4.5 to 5 times in the length, and of *B. l. americanus* is to have the head 4 to 4.5 times in the length, the statement by Hallowell that the head enters the length 4.5 times in the length does not help us in the least. And this is the only character cited by Dr. Stejneger. Nor does the locality help us, since *B. l. americanus* has been taken, according to Yanow, in Colorado, Utah, and New Mexico. These being the facts, *B. dorsalis* had to be relegated to the ignota until the type specimens could be found, and all names based on it had to lie in abeyance. The next specimen to which the name *B. woodhousei* was applied was that obtained by Möllhausen, and I therefore necessarily regarded that as the type. Had I followed a common precedent I would have sunk the name altogether, and used that of *B. frontosus* Cope, which applies to it.

However, Dr. Stejneger has now found the type in a specimen labeled as coming from the "California Mountains," a locality which I attempted in vain to discover when making out the list of specimens. It seems that this name is a "slip" for San Francisco Mountains. Dr. Stejneger discovers this by deciphering a parchment label which has soaked for some forty years in alcohol. This speaks well for the doctor's sight, for Hallowell's writing when fresh was generally nearly illegible!—E. D. COPE.

Notes on the Clawed Frog, Xenopus.—J. M. Leslie[6] has studied the habits of this South African frog. It lives on aquatic forms which it forces, into its mouth with its hands. It is apparently unable to eat out of water. Oviposition takes place in early spring (August), and the ova are deposited singly, and are attached to leaves or stones. The eggs at first measure one-sixteenth of an inch in diameter; twenty-four hours later, after swelling of the mucilaginous envelope, they measure one-eighth of an inch. The fish-like larvæ acquire no external gills, nor are there any horny plates or teeth in the mouth. Material has been forwarded to Dr. Schlaninsland, who wishes to study the development.

[6] Proc. Zool. Socy. London, 1890, p. 69.

Anatomy of Heloderma.—Dr. R. W. Shufeldt has a monograph [7] of the anatomy of this poisonous lizard, illustrated by three plates. Muscles and skeleton occupy most of the paper. No abstract is possible. Dr. Shufeldt does not decide as to the relationship of Heloderma, except in a negative way. He believes it but remotely related to the Varanidæ and Iguanidæ; so too with Lanthanotus and Crotaphytus. On the other hand, he believes that a study of Xantusia, Xenosaurus, and Lepidophyma will throw much light on these points. He does not appear to notice the fact that the question was settled by Cope, so long ago as 1866, so far as the osteology is concerned.

Birds.—Beddard concludes [8] that Psophia is nearest in osteological characters to the Cariamidæ, with resemblance to Œdicnemus, Grus, and Rhinochetus, and on the whole that it comes nearest the cranes. Grus seems to be the central from which radiate the Limicolæ, Rhinochetus, and the Ardeidæ, and the Rallidæ, Œdicnemus, Psophia, Cariama, and Gypogeranus.

The Name of the Kangaroo.—At a recent meeting of the Linnean Society of New South Wales [9] some discussion took place as to the meaning of the now universally accepted term kangaroo. It appears that it has been reported that in the language of the natives of the Endeavour River region the word kangaroo means "I don't know." This answer was given to Captain Cook in reply to some question, and he instead of appreciating its meaning, understood it to be the name of the animal to which it is universally applied.

Possible Occurrence of the Wolverine in Ohio.—While botanizing in Sugar Grove, Fairfield Co., Ohio, a citizen of the town told me that about Oct. 1, 1890, he had seen an animal descending a tree head downward. He described the animal as follows: "About the size of a large domestic cat, with rather long and very bushy tail, of dark color, striped on back like a chipmunk." I should judge from the description that the animal must have been a wolverine (*Gulo luscus* L). I know of no case on record of its occurrence in Ohio since 1842. Has any one seen it since that date? or is there some other animal that would answer the description?—E. V. WILCOX, *Columbus, Ohio.*

[7] Proc. Zool. Socy. London, 1890, p. 148.

[8] Proc, Zool. Socy. London, 1890, p. 329.

[9] *Zool. Anz.*, XIII., p. 564.

PHYSIOLOGY.[1]

Mr. Victor Horsley, F. R. S., who has done so much to advance the knowledge of cerebral localization, has been elected Fullerian Professor of Physiology at the Royal Institution of Great Britain, London.

Among the subjects of memoirs for which the Boston Society of Natural History offers prizes is "Original Investigation on the Physiology of Flight." The first prize is $60 to $100, and the second $50. The memoir must be in English, and must be presented before April 1, 1891. For particulars address the secretary, J. Walter Fewkes.

Time-Relations of Mental Phenomena.—In the sixty pages of his book,[2] Professor Jastrow has made a most excellent, valuable, and apparently careful résumé of the work done in this field. Simple reaction times are first discussed and analyzed, together with the effects of various conditions influencing them, such as the nature of the impression, the intensity of the stimulus, the mode of reaction, the subject's foreknowledge of what is to take place, distraction, practice, fatigue, and also the differences between motor and sensory reactions, individual variations, the action of drugs, and reaction times in the insane. Methods of experimentation are touched upon, and a table of simple reaction times, as determined by the leading investigators, accompanies. Complex or adaptive reactions, involving distinction and choice, are similarly treated, and an excellent and full table of complex reaction times is given. Several pages are devoted to a discussion of association times. There is added a fairly complete bibliography, made more valuable by its classification in accordance with the text.

Foster's Text-Book of Physiology.—The third part of the fifth edition of this work, just published by Macmillan, is a book of nearly three hundred pages, and is devoted to the central nervous system. The treatment of the subject has been entirely changed, much histological and other matter has been added, including excellent new figures, and the whole, nearly five times larger than its former size, may be considered practically a new work. It is doubtless entirely safe to say that it forms the best general treatment of the subject existing in English, if not in any language. It is a great advantage to have the histology discussed from the standpoint of the physiologist, with the

[1] This department is edited by Dr. Frederic S. Lee, Bryn Mawr College, Bryn Mawr, Pa.

[2] The Time-Relations of Mental Phenomena, by Joseph Jastrow. New York, N. D. C. Hodges, 1890.

function of the part ever in view. Noticeable throughout the book is the increased and careful attention paid to the differences in the actions of the nervous systems of different species of animals and the principle of evolution of function. This principle is rightly occupying an ever-widening field in physiology, and that this is so is demonstrated by the fact that this, the foremost physiological text-book in the English language, gives it prominent consideration. Also noticeable throughout is the constant endeavor to impress the reader with an idea of the extreme complexity of cerebral operations, and the present impossibility of separating from the whole and sharply formulating the functions of a particular organ, like the optic thalamus or the cerebellum. "The physiologist ought not to use the words, 'functions of the cerebellum.' From a physiological point of view it is, so to speak, a matter of accident, that various structures, the seats of various physiological processes, have, from morphological causes, been gathered together into the body which anatomists call the cerebellum. The task of the physiologist is to unravel the ties binding these various cerebellar structures with other parts of the central nervous system, and so with various parts of the body at large." The discussions of disputed points are full, lucid, and admirable. The parts on the special senses and on reproduction remain yet to be published.

The Brain of Laura Bridgman.—The case of the blind deaf-mute, Laura Bridgman, is known the world over. Born a normal child in Hanover, N. H., in 1829, she lost almost completely, at about two years of age, through an attack of scarlet fever, her special senses, except that of touch—more exactly, the left eye was entirely blinded by the disease, but sight remained, very slightly developed, in her right eye up to the eighth year; hearing and power of speech together disappeared with the disease; smell remained very unimportant and variable throughout life; taste persisted in a small degree; the temperature sense was poor, while touch continued very acute. At about eight years of age she entered the Perkins Institution, Boston, and her education was taken in charge by Dr. S. G. Howe, the director. The results of her training are well known. Her mental development became remarkable, considering her defective avenues for the incoming of sense impressions. At twenty years of age her regular education ceased, but she continued to reside at the institution until her death in May, 1889.

A study of the brain of such an individual would be interesting, as showing the correlation of brain structure and mental development. After her death the brain was placed in the hands of Dr. H. H. Donaldson, of Clark University, for study. The first report upon the subject has just been published.[1] The author has made an extremely careful

[1] *American Journal of Psychology*, Vol. III., 1890, p. 293.

and exhaustive detailed examination of the brain, and the report is a model for its fulness and careful attention to the exact description of his procedure.

The paper deals only with the gross anatomy of the brain. Estimations of the volume (1178 c.c.) and weight (1204 grms.) showed no especial deviations from those of other brains. The cerebrum was markedly brachycephalic. A general outlook over the whole encephalon showed no striking anomalies, but a careful study of the surface of the cerebral hemispheres combined with measurements of the cortical areas revealed some interesting facts. That portion of the left inferior frontal convolution, that is generally believed to contain the centre for articulate speech, was found poorly developed, and on both sides the Island of Reil was exposed more than normally, that of the left side nearly three times that of the right The occipital lobes were somewhat flattened. The *cuneus*, which is supposed to contain the centre for vision, was normal on the left side, but imperfectly developed on the right, a fact that is to be correlated with the blindness of the left eye, and the partial sensitiveness of the right eye to light for the first seven years of Laura's life. The temporal lobes were disproportionately small, but alike on both sides. No decided evidence of defective development of the centres for hearing, smell or taste, or of exaggerated development of the centre for touch, could, however, be deduced from the gross anatomy. Measurements of the cortical areas demonstrated a better superficial development of the right Island of Reil, than the left, of the right frontal lobe than the left (due largely doubtless to the defective left inferior frontal gyrus), of the left occipital lobe than the right, and of the left "residual portion" than the right. The superficial area of the whole left hemisphere was greater than that of the right, which the author associates with the fuller development of the caudal portions of the hemisphere. Compared with the measurements of H. Wagner, Jensen and Calori, Laura's brain possessed a total area small for its weight, a fairly average length and depth of its sulci, and a slightly less than average development of the area of the frontal lobes. Reports on the thickness of the cortex and on the internal anatomy and histology are not yet published.

Course of Sensory Fibres.—The course of the sensory nerve fibres through the spinal cord and brain is not so fully understood as that of the motor fibres. His believes that the real nucleus of most sensory fibres is in the ganglion of the posterior root, not in the cord. The work of Schiefferdecker, Krause, Schwalbe, Lissauer, Bechterew, Kahler, and Takacz, has shown that upon entering the cord the posterior root fibres go in two directions, namely, a portion direct into

the posterior white columns, and a portion into the grey matter of the posterior horn. Of the former, Singer's view is supported by others, and seems correct, viz.: That these fibres form long paths direct to the medulla oblongata, where they end in the nuclei of the posterior columns. From here continuing fibres go to the cerebellum and elsewhere; but the work of Edinger, Flechsig, and Meynert has proved that a great number of the continuing fibres cross to the opposite side, and as a part of the fillet go anteriorly, and end in the corpora quadrigemina. The latter portion of the posterior root fibres mentioned above, those entering the posterior cornu, disappear in its grey matter, but the connections of this are difficult to follow. Beyond the fact that fibres may be traced laterally from Clarke's column through the lateral white columns to the direct cerebellar tract, and thence anteriorly, much confusion exists as to the fate of the other posterior cornu fibres.

Edinger[1] has employed embryological combined with comparative anatomical methods, beginning with *Anguis fragilis*, and confirming his results on other reptiles, fishes, amphibians, and mammals. From the nucleus of each sensory cranial nerve (V., IX., X.) he traces a bundle of fibres across in the medulla and anteriorly as a part of the fillet to the corpora quadrigemina. The striæ acusticæ, from the nucleus of the eighth, take the same course (Monakow). Edinger calls this connection the "central sensory path" of the cranial nerves, and searches for an analogous tract in connection with the spinal nerves. In various forms he finds this in bundles of fibres emerging from the grey matter of the posterior cornu, crossing in the anterior commissure to the antero-lateral white columns, thence ascending, joining the fillet, and ending in the mid-brain. The existence of such a "central sensory path" of the spinal nerves is confirmed by physiological experiment, by embryology, *e.g.*, His, and by pathological anatomy, *e.g.*, Auerbach and Rossolymo have found this path degenerated after destruction of the posterior horns. Hence we seem to be in a fair way to understand the central connections of the posterior root fibres. Leaving out of account those going to the cerebellum, and some few others not well understood, there are two groups. In one the fibres enter the posterior columns, ascend, pass through the ganglia of those columns, cross, and as a part of the fillet go to the corpora quadrigemina. In the other the fibres join the grey matter of the posterior cornu, cross in the anterior commissure, ascend in the antero-lateral white columns, and as another part of the fillet go also to the corpora quadrigemina.

[1] *Deutsche Med. Wochenschrift*, May, 1890, No. 20, p. 421.

ENTOMOLOGY.[1]

Meeting of Economic Entomologists.—A large majority of the official economic entomologists of North America met at Champaign, Illinois, November 11th to 14th, in connection with the meetings of the Association of American Agricultural Colleges and Experiment Stations and the Association of Official Economic Entomologists. There were present Messrs. Riley and Howard, of Washington, D. C.; Forbes, Marten, Hart, and Goding, of Illinois; Atkinson, of Alabama; Gillette and Osborn, of Iowa; Bruner, of Nebraska; Beckwith, of Delaware; Harvey, of Maine; Cook, of Michigan; Woodworth, of Arkansas; Garman, of Kentucky; Fletcher, of Canada; Alwood, of Virginia; Smith, of New Jersey; Aldrich, of South Dakota; Webster, of Indiana; Snow, of Kansas; and Weed, of Ohio. The utmost harmony prevailed throughout the meeting, which was probably the most notable and profitable one ever held by the economic entomologists of the country.

Inasmuch as the Association of Colleges and Stations has been reorganized on the section plan since the Association of Economic Entomologists was formed, so that most of the members of the latter belong to a section of the former, it was decided to hold the next meeting of the latter just before the meeting of the A. A. A. S. in August, 1891. The following papers were read, Nos. 2 to 11 being presented before the Committee on Entomology of the general Association.

1. Report of Committee on Entomology, by S. A. FORBES. Read before the Association of Agricultural Colleges and Experiment Stations. This consisted of a masterly review of the work in entomology carried on at the stations during the year.

2. Notes on Insecticides, by M. M. BECKWITH, detailing experiences in fighting the rose chafer, spraying for the codling moth, etc.

3. A New Root Rot of Cotton, by G. F. ATKINSON, showing that cotton roots are attacked by Nematodes, and serious injury is sometimes done.

4. Experiments and Observations in Iowa, by C. P. GILLETTE, reviewing the more important results obtained at the Iowa Station this year.

5. Methods of Laboratory Experiment, by C. W. WOODWORTH. A general discussion of methods of testing the effects of arsenites upon plant foliage, and ways of tabulating results.

[1] Edited by Dr. C. M. Weed, Experiment Station, Columbus, O.

6. New Notes on the Hessian Fly, by JOHN MARTEN, showing that there may be a fourth brood at times.

7. Life-History of *Baris confinis*, by C. M. WEED, showing that this insect develops in Spanish needles (Bidens sp.)

8. Life-History of Certain Aphididæ, by C. M. WEED, showing the autumn and winter history of a number of little-known species.

9. Life-History of *Pimpla inquisitor*, by C. M. WEED, detailing observations on the egg and larval history of this insect.

10. Contagious Diseases of Chinch Bug, by F. H. SNOW, reporting a number of successful experiments in spreading contagious disease among chinch bugs.

11. Host Relations of Hymenopterous Parasites, by L. O. HOWARD, showing the need of more precise knowledge of breeding habits of parasites, and the value of knowing the biological laws governing them.

The following papers were read before the Association of Official Economic Entomologists:

12. Address of the President, by C. V. RILEY, reviewing recent entomological work of the Department of Agriculture, and many other points of general interest.

13. Our Work and Bulletins, by A. J. COOK. A general discussion of the scope of entomological work at the stations, and methods of publication.

14. Fertilizers as Insecticides, by J. B. SMITH, showing the value of potash salts as insect destroyers.

15. The Habits of Pachyneuron, by L. O. HOWARD.

16. Notes on the Plum Curculio, by J. B. SMITH, reporting a number of observations upon this insect.

17. Notes on a New Apple Pest, by F. W. GODING.

18. Notes on the Genus Phylloxera, by C. V. RILEY.

19. An Experience with the Rose Bug, by J. B. SMITH, showing the inefficiency of nearly all ordinary insecticides.

20. Some Questions Relating to Aphides, by J. B. SMITH, discussing the poriferous structure of the antennæ, and its significance.

21. Notes on the Plum Curculio and Gouger, by C. P. GILLETTE, reporting observations on life-history, and experiments with remedies.

22. Original Work at the Stations, by C. V. RILEY. A general discussion of the subject.

23. Notes on Beet-Root Insects, by L. BRUNER, detailing observations made in Nebraska.

24. Invasion by the Clover-Leaf Beetle, by J. B. SMITH.

25. London Purple on Peach, by A. J. COOK, reviewing spraying experiments in Michigan and at Cornell University.

26. Life-History of White Grubs, by S. A. FORBES, showing that all our common species pupate in the fall, and describing early stages of several species.

27. Life-History of the Corn-Plant Louse, by S. A. FORBES, reporting investigations during a number of years by which many new points in the life-history of this insect have been brought out.

In addition to these numerous papers, the discussions throughout were of unusual interest. The entomologists are certainly to be congratulated on the large attendance and number of papers, as well as the evident desire manifested throughout the sessions to help each other in forwarding the work in which they are engaged.—CLARENCE M. WEED.

The Screw Worm.—Two bulletins concerning this insect (*Compsomyia macellaria*) have lately been issued. The first is by Dr. M. Francis, of the Texas Experiment Station, and the second by Prof. H. A. Morgan, of the Louisiana Station. That by Dr. Francis is quite short, but gives illustrations of all the stages of the insect, engraved from drawings by Miss Freda Detmers, which are shown at Plate XXXV. Dr. Francis quotes from a letter in which Dr. S. W. Williston states that the fly "occurs everywhere from Canada to Patagonia," but adds that only in Texas is it of economic importance in the United States. Cattle are especially liable to attack, but horses, mules, hogs, sheep, dogs, and in some recorded cases even men, are attacked. Dr. Francis continues:

"In all animals alike, the eggs, after being laid by the fly, hatch into larvæ or so-called 'worms.' The exact length of time this requires seems to vary with circumstances. My present opinion is that, if the eggs are laid in a moist place and on a warm day, it requires less than one hour; whereas, if laid in a dry place they seem to dry up and lose their vitality. The young larvæ when first hatched are small and easily overlooked. If they are hatched on the surface in a drop of blood from a ruptured tick, for instance, they attempt to perforate the skin, and if hatched in wounds they at once become buried out of sight. They seem to attach themselves by their heads, and burrow their way under the skin, completely devouring the soft flesh. Occasionally a few are seen moving from one place to another, but usually they remain fixed at one point. The worms grow steadily in size, and the hole in the flesh becomes larger every day. Sometimes the worm makes tunnels, but not to any depth; they usually stay on the surface.

They evidently produce considerable irritation, for the part is always swollen and constantly bleeding. This swollen, gaping appearance of the wounds, together with the constant discharge of blood, are characteristic of the presence of worms. It seems to require about a week for the worms to become fully grown. At that time they are about five-eighths to six-eighths of an inch long. They then leave the sore and go into the ground, where they pass the pupa state, and hatch out as flies in from nine to twelve days. Of several hundred hatched out by the writer, the shortest time was nine days and the longest fourteen days, but in the majority of cases it required from nine to twelve days. While the larvæ are thus developing the flies are constantly laying fresh eggs in the wounds, so that the young worms take the place of the matured ones, and thus keep up a constant and progressive loss of tissue. If the worms are not killed they eat constantly deeper, and often kill the animal. Sometimes the abdomen is opened and the bowels escape—as is especially liable in case of heifers spayed through the abdomen. At other times a tail is eaten off, or extensive caverns are made into the muscles.

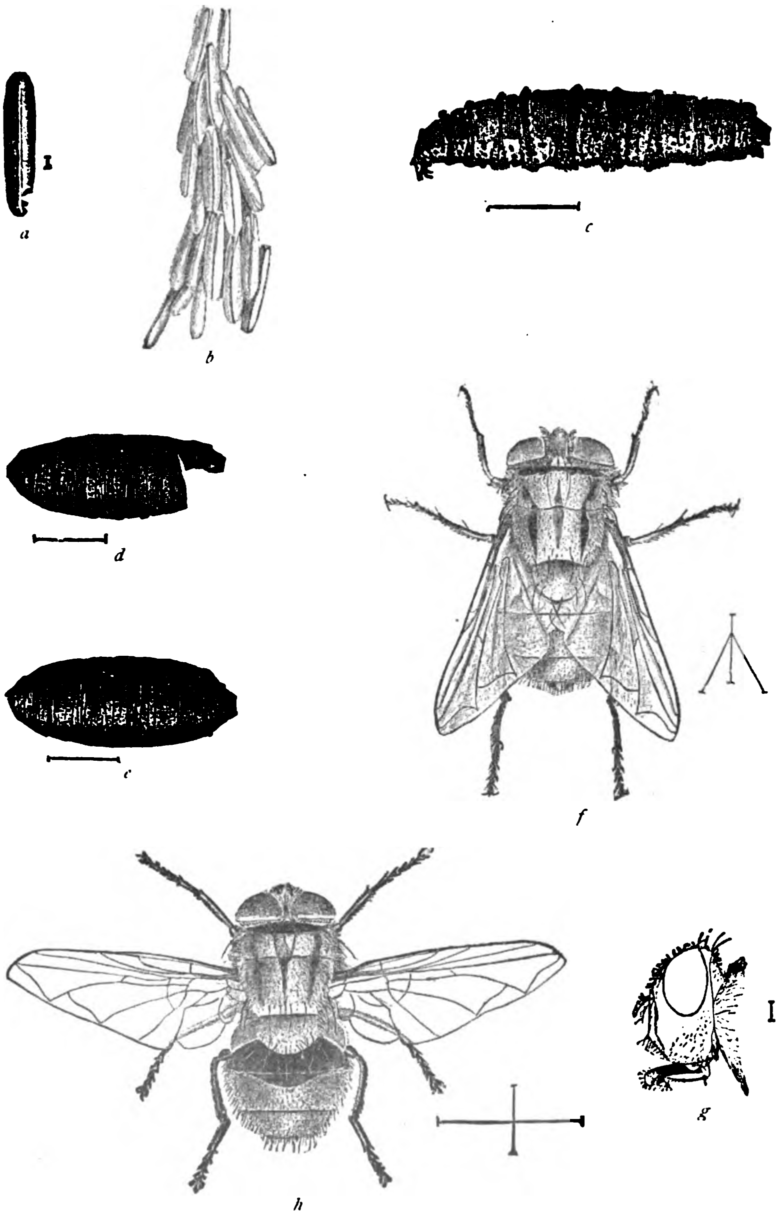
"The treatment usually employed in these cases consists simply of killing the larvæ with cresylic ointment, calomel, chloroform, or carbolic acid."

In the accompanying plate the eggs are shown at *a* and *b*, the first representing a single egg, greatly enlarged, and the second a bunch of eggs, also enlarged; the larva is represented at *c*, and the puparium at *d* and *e*, the former showing the mode of exit of the fly, which is represented at *f* and *h*, while *g* represents a side view of the head.

The egg of this insect is 1 mm. long, whitish, and cylindrical, with a longitudinal ridge on one side. The full-grown larva is 16 mm. long by 4 mm. in diameter. It is a whitish, footless grub, with transverse rows of stiff black bristles at each articulation. The puparium is brown, 10 mm. long by 3 mm. thick. The imago is described as follows: Length, 10 mm.; wing expanse, 21 mm.; color, metallic bluish-green, with golden reflections; thorax, with three black longitudinal stripes; head, except central portion of eyes, yellow; legs, black; wing veins, black; wings transparent, except near base, where they are slightly clouded. Entire body furnished with long, black, spinose hairs. Proboscis of medium length, with dilated tip.

The past summer this insect appeared in injurious numbers in parts of Louisiana and Mississippi, where it has seldom heretofore attracted attention. Prof. Morgan thinks it was imported the previous season with Texas cattle, and on account of the mild winter was not killed by

PLATE XXXV.



THE SCREW WORM (*Compsomyia macellaria*).

the frost. He has found that it is able to develop freely in decaying animal and vegetable matter.

An article concerning the appearance and injuries of the screw worm in Mississippi has lately been published by Mr. H. E. Weed, of the Experiment Station of that State, in the *Southern Live Stock Journal* (Nov. 6, 1890).—C. M. W.

North American Phycitidæ.—After many years of study of the small moths of the family Phycitidæ, Rev. Geo. D. Hulst has prepared a monograph of unusual excellence. It has been published under the title, "The Phycitidæ of North America," in the Transactions of the American Entomological Society (Vol. XVII., pp. 93–228, Plates VI.–VIII.) The systematic list given at the end of the article includes 201 species, although the author states in the opening paragraph that "it is probable that not half of our species have as yet been described." This monograph cannot fail to be of great value to working entomologists, and ought greatly to stimulate the study of these beautiful little moths. The early stages of only twenty-six species are recorded as known. The author, following his previous custom, has proposed a number of new generic terms derived from the names of extinct Indian tribes. The generic references of nearly all the well-dnown economic species have been changed; *e.g.*, the leaf crumpler (*Phycis indigenella* of authors) is now *Mineola indigenella;* the leaf skeletonizer, which so long has been called *Pempelia hammondi*, now goes to the genus Canarsia; Professor Comstock's *Dakruma coccidivora* has become a Lætilia, and the time-honored *Ephestia interpunctella* has gone back to Guené's genus Plodia, in which it seems to have been originally placed by Hübner. But these changes are inevitable, and we can only trust that the insects mentioned have received a fairly permanent generic assignment.

New Food-Plant of Rhodobænus 13-punctatus.—Pupæ and adults of this species were found in the stems of cupweed (*Silphium perfoliatum*) July 30, 1890, in central Ohio. The beetles were freshly emerged, and were crawling up the inside of the stem, evidently preparing to escape. The pupæ were in the basal portion, where abundant evidence was visible of the work of the larvæ. The latter had bored the root and basal part of the stem. No larvæ could be found at this time, all having pupated. The two later stages of the insect are shown at Fig. 1, *a* representing the pupa, and *b* the beetle. The larva has been described by Dr. Riley in the Report of the U. S. Department of Agriculture for 1881–1882 (p. 142); and in his third

Missouri Report the same author gives an account of what is supposed to be this species under the name *Sphenophorus pulchellus*. The insect

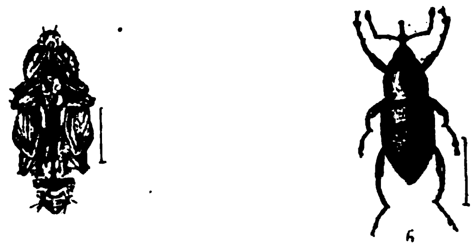


FIG. 1.—*Rhodobænus 13-punctatus*; *a*, pupa; *b*, beetle. Both enlarged. Original.

is there called the Cocklebur Sphenophorus, and the larva is said to bore the stalks of the common cocklebur (*Xanthium strumarium*).—CLARENCE M. WEED.

Elm Insects.—Prof. G. H. Perkins has recently distributed a 96-page memoir, extracted from the Eleventh Report of the Vermont State Board of Agriculture, upon Insects Injurious to the American Elm. Eighteen introductory pages are devoted to a consideration of predaceous and parasitic insects, insectivorous birds and other animals, and the use of insectides. Then follows a short discussion of the usefulness of the American elm, and the reasons for treating of the insects affecting it, after which appears a systematic list of seventy-eight insects injurious to the elm. A more or less complete account is then given of each of these species, the writings and illustrations of previous authors being freely used, with full credit. Unfortunately the otherwise excellent mechanical execution of the *brochure* is seriously marred by the occurrence of numerous typographical errors. In several places also slips occur, due, apparently, to a lack of the latest information. For instance, in discussing kerosene emulsion, "Prof. Riley's recipe" is said to be "a mixture of oil and milk of any desired proportions," and no mention is made of the Riley-Hubbard soap emulsion, which is now the accepted formula everywhere. And under the head of beetles infesting elms a list of species mentioned by Glover and Harris is given, the names of many of which have since been changed, and some of which are synonyms. The genera Phyllophaga and Trichestes are not now recognized in the lists of American Coleoptera. The imported coccid (*Gossypari ulmi*) is called the imported elm leaf aphis. This is unfortunate, as the term aphis should at least be restricted to insects of the family Aphididæ. But

notwithstanding these occasional slips, Professor Perkins has done a very useful work in a line where his example may well be followed.

North American Pselaphidæ.—Messrs. E. Brendel and H. F. Wickham have lately published in the Bulletin from the Natural History Laboratories of the Iowa State University (Vol. I., pp. 216–304, and Vol. II., pp. 1–84) a Monograph of the Pselaphidæ of North America, which shows evidence of much careful work. Seven plates from stipple drawings by Dr. Brendel, the senior author, fairly well represent the species described. This monograph will be a great help in the determination of species in this difficult family of beetles.

MICROSCOPY.[1]

Direct Division of the Nucleus in the Enteric Epithelium of Rhabdonema nigrovenosum.[2]—Prof. Hoyer finds in the epithelium lining the alimentary tract of Rhabdonema good material for demonstrating the so-called "direct" division of nuclei. Hoyer admits, however, that his preparations are not conclusive evidence of such division.

Following Kultzitzky's method, Prof. Hoyer killed the Nematodes in "strong alcohol," stained in alcoholic borax-carmine 24hs., decolorized in acidified alcohol 1h. (strong alcohol + 1% HCl.), transferred to glacial acetic acid (15m.), then to a mixture in equal parts of glacial acetic acid with creosote, then to pure creosote, and finally mounted in creosote balsam.

Such treatment, we should think, would be likely to bring out "direct" division. We agree with Hoyer that the case needs further investigation.

Culture of the Larvæ of Ascidians, Worms, Echinoderms, etc.[3]—Dr. Ch. Julin has found the following method, suggested by Prof. Giard, to be very useful in rearing larvæ of various kinds. Material for the study of the formation of the colonies of compound Ascidians may be easily obtained in this way:

Collect the free larvæ in a pipette at the time of hatching, and place them in covered watch-glasses containing clean sea-water. Keep them protected from the light (half-dark). "Thus kept, they develop quite

[1] Edited by C. O. Whitman, Clark University, Worcester, Mass.

[2] H. Hoyer. *Anat. Anz.*, V., 1, Jan. 1890, p. 26.

[3] Extracted from a letter from Dr. Ch. Julin to Dr. Minot, dated Sept. 3, 1889.

normally. I have thus been able to obtain excellent material for the Ascidians, and I have made successful cultures of many kinds of Annelid larvæ."

Preservation of Siphonophora.[4]—Bedot proceeds as follows: The colony is immersed in a 15–20 per cent. aqueous solution of sulphate of copper. At the same time sea-water is poured in along with the colony, in such bulk that the copper solution is ten times as great. After fixation, which happens in a few minutes, a few drops of nitric acid are added to the solution, and the mixture is gently stirred up with a glass rod, in order to prevent the formation of any precipitate. After four or five hours the preparation is to be further hardened in Flemming's mixture:

Chromic acid (1 per cent.)	15 parts.
Osmic acid (2 per cent.)	4 parts.
Glacial acetic acid	1 part.

This fluid should be allowed to act twenty-four hours, and should be twice the volume of the copper solution. A few drops of 25 per cent. alcohol are next added to the fluid, and the quantity and strength of the alcohol gradually increased, until in fifteen days 70 per cent. may be used, and finally 90 per cent.

For Tracing Nerve Fibres in the Brain.[5]—For the study of the finer structure of the fore-brain of Amphibia, Oyarzun recommends Golgi's silver method, as improved by Ramon y Cajal (*Anat. Anz.*, V., 3, 1890, p. 85). The brain is treated first twenty-four hours in the following mixture (kept dark):

Bichromate of potash (3 per cent. aqueous solution)	20 parts.
Osmic acid (1 per cent.)	5 parts.

After washing some seconds, the preparation is placed in silver nitrate solution, which should be renewed once; it is then exposed to the light. The silver solution consists of

Argentum nitric cryst.	75 gr.
Aq. dist.	100 c.cm.

This solution is followed after twenty-four hours by alcohol, to complete the hardening.

[4] *Arch. Sci. Phys. et Nat.*, XXI., 1889, p. 556; *Jour. Roy. Mic. Soc.*, Dec. 1889, p. 832.
[5] Oyarzun. *Arch. f. Mik. Anat.* XXXV., 3. 1890, p. 380.

New Methods of Staining Nerves with Methylblue.[6]—Prof. Dogiel says that nerves may be stained with methylblue, not only in muscles, but also in other organs, and in a simpler way than that of Ehrlich. It is sufficient simply to inject the vessels of the organ with a 4 per cent. solution of methylblue in the physiological salt solution. The injection is performed immediately after the death of the animal. Usually the organ is left *in situ* until the stain takes effect; but, if sufficiently thin, it can be cut out and placed in a drop of aqueous humor, and watched under the microscope until the desired effect appears. In the first case the organ must be laid bare, and its cavities, if it have any, must be opened. The stain may appear in the course of a few minutes, but often only after an hour or two. In the second case the conditions are most favorable, not only for staining, but for observing the action of the stain and noting the exact time for fixation.

A simpler method still may be employed for the demonstration of nerves in certain organs and tissues. The tissue is taken from the animal while living, or just after killing, and placed on a slide or in a watch-glass in a few drops of aqueous humor, to which are added 2–3 drops of a $\frac{1}{15}-\frac{1}{16}$ per cent. methylblue solution in the physiological salt solution. Ordinarily the stain appears in the nerves in 5–10 minutes; but the time depends much upon the thickness of the tissue. In the retina, for example, 2–3 hours or more may be required to bring out the nerves of the different layers. The nerves of cold-blooded animals stain more slowly than those of warm-blooded ones.

The fixation of the color may be accomplished conveniently by picrate of ammonium, which produces a fine, granular, violet precipitate with the methylblue, and at the same time renders the tissues quite transparent. This reagent also softens the tissue, so that it can easily be separated by the aid of needles. Twenty to thirty minutes are usually sufficient to fix the stain; but thick tissues may require from two to twelve hours.

It is important that the original blue color be made to pass into a violet without the least tinge of green; otherwise the preparation may quickly fade.

The preparation may be mounted in dilute glycerine.

A saturated alcoholic solution of picrate of ammonia will harden the tissue, so that it can be cut in pith or liver, and the sections mounted in glycerine.

[6] Dogiel. *Arch. f. Mik. Anat.*, XXXV., 3, 1890, pp. 306–312.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Boston Society of Natural History.—November 5th.—Mr. G. H. Barton read a paper on the "Drumlins of Massachusetts"; Prof. F. W. Putnam spoke on the "Archeological Explorations in Ohio during the Past Season." November 19th.—Mr. Nathan Appleton read a paper on "Santo Domingo." December 3d.—Dr. J. Walter Fewkes spoke of "The Summer Ceremonials of the Zuñi Indians: a Study of Aboriginal Religion."—J. WALTER FEWKES, *Secretary*.

Biological Society of Washington.—November 1st, 1890.—Mr. F. V. Coville spoke of the fruiting of Ginkgo at Washington. This tree has only rarely fruited in America, due to the fact that it is diœcious, and the staminate tree only is planted. A large specimen was referred to as growing on Analostan Island, near Washington. This tree is probably as old as any in this country, and is about three feet in diameter. The fruit described by Mr. Coville resembles a plum in general appearance, having a soft pulp surrounding a hard nutlet. The morphology of the fruit was explained, it being really a naked seed, the outer part soft and pulpy, the inner hard and nut-like. The fruit represents a single female flower with a single bract. The seed contains a large amount of albumen surrounding the embryo, which is dicotyledonous, and not polycotyledonous as in most conifers. The embryo grows after the seed is mature, and often even after it has fallen to the ground. In Japan the nutlet is eaten like the piñons of the western part of our country. The pulp has the disagreeable odor of sour paste.

In speaking of the mode of growth of the Ginkgo, Dr. C. V. Riley referred to the difference in appearance between trees in the agricultural grounds and others he had seen in Europe. The former were pyramidal, but the latter branched more widely and looked like oaks. He also said the species was, so far as he knew, entirely free from insect pests, and on this account was valuable as a shade tree.

Mr. Coville also spoke of its value as a shade tree, as it would grow in the sooty atmosphere of towns, and it was not affected by any fungus diseases.

Dr. George Marx spoke at some length on the poison glands of the genus of spiders Latrodectus. His investigations were undertaken in consequence of the accounts received of the serious effects of the

bite, a man having died in twelve hours after being bitten by one. That the poison was useful to the spider in killing its prey was unquestioned, but that it was powerful enough to cause the death of a man was considered doubtful. The mandibles are hollow, and from apertures near the end the poison is ejected. This poison is contained in a poison sac lying above. It varies in shape in different species, and is squeezed out by muscular contraction. The gland in the genus under consideration is very small, averaging 2 mm. long and 2 mm. wide, with a capacity of .07 cubic mm. The poison is clear, viscid, and has an acid reaction. It frequently becomes turbid. It will not mix with water, but remains in the form of granules.

Latrodectus lives under stones, and spins no web. Unlike most spiders, it drinks no water, and has a great dislike of it. If a drop be placed upon its back it goes almost into spasms, and for hours afterwards tries to brush the water off. Water destroys the poisonous qualities of the poison. In pursuing its prey in a glass jar it was seen to crawl up the sides and from its spinnerets eject several drops of a viscid fluid. The prey having been bitten, is left, and the spider returns and devours the fluid previously ejected. As to the poisonous effects of spiders' poison, it was stated that a rice bird died in seventeen seconds after having been bitten by the Mygale, or bird-catching spider. Another died in thirty seconds. Experiments to test the poison of Latrodectus were all negative, neither a rabbit, a guinea-pig, nor a mouse being affected in the slightest. The idea that spiders of this genus are capable of inflicting bites severe enough to be harmful is very widespread, but Dr. Marx regarded it as a superstition with little real foundation.

Dr. C. V. Riley stated that he believed there was some truth in the accounts of injury by spider-bites. Some cases are too well authenticated to be doubted. He referred to the different effects a bite or a sting might have upon different persons, and while one would be unaffected, another might be very seriously poisoned. He spoke of a friend who was at one time noted for his skill in handling bees, and he was never stung. But on one occasion he was stung, and so severely that he came near dying. After that he could not go near the bees without being stung and being poisoned by it.

Dr. Theobald Smith stated that the effect of poison was somewhat analogous to that produced by bacteria. It was commonly supposed that diseases were caused by the rapid and excessive multiplication of bacteria. This seems to be a mistake, and it is to a poison produced during the increase of the bacteria that the ill effects are due. Ani-

mals can be innoculated with rattlesnake poison, and can eventually be bitten and experience no bad effects.

Prof. Joseph F. James read a paper upon "Fucoids and Other Problematic Organisms." He referred to his studies of the problematic organisms. He did not consider that the absence of carbonaceous matter was any evidence in itself that the forms were not Algæ. Under the head of "Probabilities of Preservation of Algæ" he referred to the structure and place of growth of sea-weeds, and quoted Lesquereux's opinion that the plants are very rarely preserved, stating further that the strata containing the problematic organisms contain no fossil shells in anything like a perfect condition. Fragments are found in quantities, and if calcareous organisms are destroyed cellular Algæ would stand a much poorer chance. The exposed beaches would, however, be in an admirable position to retain raindrop impressions, mud cracks, and other inorganic markings, as well as worm burrows or trails made by shells or crustaceans. Under the head of "Distribution in Space and Time" he briefly outlined the localities and the formations in which various genera occur; and under the head of "Value in Correlation" spoke of Scolithus as having been largely used to characterize the Potsdam, whereas it occurs in Lower Cambrian, Calciferous, and Medina strata also. He did not regard the problematic organisms as of value *by themselves*, but taken in connection with lithology, stratigraphy, sedimentation, and the presence of undoubted organic remains, they might be of some use. He could see no objection to the naming and description of the forms if they were regarded as crustacean, or Annelid trails or borings, or as of inorganic origin; but he thought they should not be referred to the Algæ when they had no affinity to plants.

November 15th, 1890.—Dr. C. Hart Merriam gave a short account of some of his experiences during the past summer in the cañon and lava beds of the Snake River country, Idaho. The lava beds are many hundreds of miles in extent to the north of the river, but are much smaller on the south. The country is peculiar and forbidding in aspect. Two or three buttes are known in the region, one of which is a great volcanic cone over 2,000 feet high. Lava flows and ridges are frequent, some of the former having a very recent aspect, the twists and bubbles of the lava being still plainly visible. The crust of the bubbles is a foot or two thick, and as it is liable to break at any time and allow the horse or the man to tumble into the hollow below, traveling is difficult and tiresome. The lack of water renders parts of the country almost inaccessible, and the heat in summer is intense.

Many animals live in the caves formed by the lava bubbles, there being hundreds and thousands of these.

The Snake River cuts into the lava field to a depth of 800 feet. The cliffs are of black lava, very dark, and make the cañon look deeper than it really is. The cliffs are frequently perpendicular, and are without vegetation. The lava rests upon a limestone. Shoshone Falls was referred to as very grand and beautiful, the water falling in one drop 210 feet, but having a total fall of 250 feet. A few miles above is another fall 175 feet high, and many cascades and rapids render the river unnavigable. Where vegetation is possible on the lava beds it consists almost entirely of sage bush (*Artemesia tridentata*) and several species of the so-called greasewood. Many springs are found along the base of the cliffs in the cañon, the water of these being relatively warm. Some of them are very large; four or five are even twenty feet across.

Among the insects is one known as the "Idaho Devil," about two and one-half inches long, as large as one's finger, and with a large head. It is extremely ferocious. Ants are also abundant. Some of them build nests or hills five or six feet high, made entirely of sticks, all of the same size and length; other kinds make hills of stones, these being also all of the same size. The ants hibernate in cold weather. A few birds are found, the most abundant being the sage sparrow. Mountain mocking birds, magpies, ravens, eagles, burrowing owls, ground doves, rock wrens, and cañon wrens also are found. The last, though only about as long as one's finger, has a piercing cry that can be heard several miles.

Among animals, coyotes and rabbits abound; of the latter there are four or five species. In the cañons in winter antelope and black-tailed deer are found, while panthers, badgers, wood-rats, mice, porcupines, and others live in the cañon all the year. Horned toads and rattlesnakes also frequently occur.

Mr. Theodor Holm spoke of the vegetative reproduction of *Dicentra cucullaria*. This plant is peculiar from having at the base a number of round, bulb-like bodies, which have been generally described as tubers. They are not really such, but are buds, producing late in summer or early fall, from a small depression at one end, a branch with several leaves. They are in one sense equivalent to the bulbous bases which the leaves of certain species of plants have.

Dr. W. H. Dall made some remarks upon the paleontology of the northwest coast of the United States. Certain specimens of Tertiary fossils in the collections of the Wilkes Exploring Expedition were

from unknown localities, and it was desirable to ascertain, if possible, the exact horizon whence they came. Astoria was the first place visited. It was described as being peculiarly situated, a portion being built upon the bluff overhanging the Columbia River, and the other portion occupying a narrow beach along the margin of the river. The latter part was largely built upon piles, and streets and houses extended out over the water. The houses at the foot of the bluff frequently extended into its face. The top of the bluff is covered by about six feet of basalt, below which lie Tertiary strata, layers of brown sandstone, and many nodules or concretions containing fossils. The Miocene sandstone is underlaid by Eocene limestone, in a layer about one foot thick. It was from this layer that many of the fossils were collected by the Wilkes Expedition, but it is now covered by the piles and streets and houses of the town, and is inaccessible.

The Plistocene strata on the coast rise gradually toward the south until at Monterey and south it is about six hundred feet above sea-level. The Oregonian forms are those of species living at present to the north in the colder waters of the Arctic regions; while the forms at the south are those living at present in the neighboring sea. The large lake basins of the Cascade region were referred to, many of them being occupied at present by small bodies of water more or less alkaline. Those having outlets, and consequently fresh, have a large fauna, while the alkaline lakes have no animals living in them of consequence. In marl along the Klamath Lake shells are found which live to-day in the neighboring water. But among them are some not now known to occur in a living state. Among these are species of Vivipara and Unio. These genera, though very abundant in the Mississippi valley, are unknown in a living state west of the Rocky Mountains, though they occur as fossils as early as the Laramie period. It is an interesting problem to decide why some genera should become extinct while others in the same localities lived on.

Reference was made to Stockton in the Sacramento valley, where a boring revealed gas in sufficient quantity to heat and light a large house. The city has put down numerous artesian wells, and the water thus obtained is used for domestic purposes. Some of the wells are 2000 feet deep, yet in no instance was solid rock encountered. It was all detrital material, generally coarse sand or clay. In one locality a bed of cobblestones was encountered of very local extent, being only about eighty feet wide, one and a half miles long, and from three to four feet thick. This was an isolated mass in the midst of sand or gravel. In all of the borings, many hundreds in number, no bones or wood have ever been found.

SCIENTIFIC NEWS.

Preventive Inoculations Against Tuberculosis.—At the recent meeting of the International Medical Congress, in Berlin, Dr. Robert Koch made an address in which he asserted that he had discovered a method by which animals ordinarily very susceptible to contract tuberculosis from inoculations of the bacillus were made capable of resisting such inoculations. The details of his method he did not make public. Stimulated apparently by this announcement, which is calculated to attract widespread attention, Drs. Grancher and Martin, of Paris, announced in the *Bulletin Médical,* August 20, 1890, that they also had devised a method by which these results could be obtained.

In the *Medical and Surgical Reporter* Professor Samuel G. Dixon, of Philadelphia, presents a short article in which attention is called to the fact that a year ago—October 19, 1889—he had proposed the lines upon which preventive inoculations against tuberculosis might be expected to be successfully carried out, and that he had already succeeded in a certain number of instances in producing immunity against the disease in animals. The announcement antedates by so much the announcements of Koch, and Grancher and Martin, that American medical men must feel an interest in maintaining the priority which belongs to this country.

In this particular matter it may be pointed out that Dr. Dixon in his announcement gives some indications as to the method by which he obtains the attenuated virus used in his experiments. Intimations of this sort are totally lacking in the communications of Koch, Grancher and Martin.

President Charles A. Schaeffer, of the Iowa State University, was the recipient for the university of a valuable gift from a Sioux City gentleman. The gift consists of the entire scientific collection and library of D. H. Talbot. Mr. Talbot is an old resident of Sioux City, living north of the city on a farm, where he has for years carried on the study of natural history and of science. His farm is stocked with animals of all kinds, and he has made a special study of their habits. He has also made a remarkable collection of preserved specimens. These specimens and his library are conveyed to the state university for the benefit and advancement of science. The library will remain with him until his death, but the specimens will at once be taken to the state university at Iowa City.

The library consists of about 4,000 volumes, some of them rare and valuable works, and containing treatises on almost every scientific subject. It is indeed a wonderful collection of scientific works. To place an accurate valuation upon it would be impossible, but those who are in a position to have a general knowledge of the library say that $20,000 would be a conservative estimate of its value. Some of the single books are alone worth a great deal on account of their rarity. Mr. Talbot is a diligent student of science, and he has some knowledge of almost every subject treated of in the whole library.

ERRATA.

Correction of Misprints.—Owing to the circumstance that Dr. G. Baur did not receive any proofs of his notes published in this journal a great number of misprints occur which need correction.

1. "The Gigantic Land Tortoises of the Galapagos Islands," December, 1889, pp. 1039–1057.

   Page 1039, line 4 from below, read "T. N. Reynolds" for "Z. N. Rheynolds."

   Page 1044, line 2 from above, add "I am convinced that *T. vicina* Guenther is the same as *T. elephantopus* Harlan."

   Page 1044, line 3 from below, read "schaetzte" for "schaetzts"; "wurden" for "den war."

   Page 1045, line 19 from above, read "Bindloe" for "Burnloe."

   Page 1045, line 24 from above, read "island" for "land."

   Page 1047, line 8 from below, after "island" put "[Hood]."

   Page 1057, line 6 from above, read "230" for "2300."

   Page 1057, line 17 from above, read "ten millions" for "one hundred thousand."

2. "The Relationship of the Genus Dirochelys," December, 1889, pp. 1099–1100.

   Page 1099, line 16 from above, read "*dorsalis*" for "*dorsalia*."

   Page 1099, line 2 from below, read "*orbicularis*" for "*orbicularia*."

   Page 1100, line 5 from above, "Deirchelys Ag. (name only)" has to be placed on line 6 behind Dirochelys Ag.

3. "The Genera of the Podocnemididæ," May, 1890, pp. 482–484.

   Page 483, line 11 from below, read "cervicals" for "cervical."

   Page 484, line 1 from above, read "Sternothæridæ" for "Pelomedusidæ."

4. "Note on the Genera Hydraspis and Rhinemys," *ib.*, pp. 484–485.
   Page 484, line 10 from below, read "which he considers the type" for "which I consider the type."
   Page 485, line 5 from above, read "Phrynops" for "Rhinemys."
   Page 485, line 5 from above, after "Schweigg." insert, "The type of Rhinemys is *Emys rufipes* Spix."

5. "On the Classification of the Testudinata," June, 1890, pp. 530–536.
   Page 530, line 8 from below, read "Testudinata" for "Testudinate."
   Page 531, line 18 from above, read "Bull. Soc. Philom." for "Brit. Soc. Philos."
   Page 531, line 19 from above, read "Ordn." for "Order."
   Page 531, line 8 from below, read "1802" for "1806."
   Page 532, line 5 from above, read "Ritgen" for "Ritzen."
   Page 532, line 7 from above, read "Vergl." for "Vogl."
   Page 532, line 7 from above, read "I. Aufl." for "Aufl."
   Page 532, line 13 from above, read "place" for "plate."
   Page 532, line 13 from below, insert quotation marks after "supposed."
   Page 532, line 12 from below, take out quotation marks after "assigned."
   Page 532, line 8 from below, read remove "Bemerkungen über die systematische."
   Page 533, line 9 from below, read "nuchal" for "nuchol."
   Page 533, line 4 from below, read "bone" for "line."
   Page 534, line 2 from below, read "four" for "five."
   Page 535, line 5 from below, place "or" before "entirely."

6. "An Apparently New Species of Chelys," October, 1890, pp. 967–968,
   Page 968, line 1 from above, read "jaws without horny beak" for "jaws."
   Page 968, line 5 from above, read "shows" for "showed."
   Page 968, line 6 from above, read "palates" for "plates."
   Page 968, line 17 from above, read "hardly" for "harely."
   Page 968, line 19 from above, read "catalogue" for "catilogue."